Information Technologies as Instruments of Social Transformation: The Computerization of Classical Scholarship

Karen Ruhleder

Department of Information and Computer Science
University of California, Irvine, CA 92717

Technical Report 91-52

May 24, 1991

SYDNEY OMARR

Astrological Forecast

Aries (March 21-April 19): Questions arise concerning legal affairs, cooperative efforts, marriage. Articulate feelings, let others know you can write and express ideas in meaningful manner.

Taurus (April 20-May 20): Domestic adjustment could include residence, possible sale or purchase of art object, luxury item. Marital status also plays significant role.

Gemini (May 21-June 20): Obsequious individual wants something for nothing; you could be prime target. Protect self in clinches, refuse to give up something of value for mere whispered promise. Virgo involved.

Cancer (June 21-July 22): Focus on power, authority, promotion, deadline. Attention revolves around residence, security, removal of safety hazards. Check durability of goods, inventory, accounting procedures. Selectivity.

Leo (July 23-Aug. 22): Assignment will be completed, you'll be pleased, others might express astonishment. Focus on wider audience, communication, possible journey.

Virgo (Aug. 23-Sept. 22): Outmoded methods will be tossed aside. You'll benefit. Accent independence, originality, daring. Money picture bright.

Libra (Sept. 23-Oct. 22): Follow through on hunch, refuse to follow crowd, trust inner voice. Emphasis on appearance, confidence, ability to get to heart of matters. Learn through process of teaching others. Aquarian involved.

Scorpio (Oct. 23-Nov. 21): Diversify, give full play to intellectual curiosity. Social activities accelerate, popularity rating zooms upward. What you feared turns out to be paper tiger.

Sagittarius (Nov. 22-Dec. 21): What at first appeared to be empty promise turns out to be solid. Check details, fill out proper forms, correct recent mistake. You're on way to emotional and financial fulfillment.

Capricorn (Dec. 22-Jan. 19): Outlet discovered for creative expression. Scenario features vindication, key to goose that laid golden egg.

Aquarius (Jan. 20-Feb. 18): Family member says, "I see no need for peace treaty between us since we never were at war." Accept offer of reconciliation. Focus on diplomacy, communication, possible journey. Taurus plays role.

Pisces (Feb. 19-March 20): What appeared far away is closer than anticipated. You could receive package wrapped in silk. Focus on mirage, illusion, sensitivity, psychic prediction.

If May 24 is your birthday: You have unusual voice, are romantic, idealistic, sensitive, appreciate drama, music. Taurus, Libra, Scorpio persons are drawn to you. Romance highlighted in June, along with fresh start in new direction. You'll complete project in July, and marital status will be featured. Social activities accelerate in August—you'll travel, add to wardrobe, be very much aware of body image. Major domestic adjustment takes place in November.

The astrological forecast should be read for entertainment only.

UNIVERSITY OF CALIFORNIA

IRVINE

Information Technologies as Instruments of Social Transformation

The Computerization of Classical Scholarship

DISSERTATION

submitted in partial satisfaction of the requirements for the degree

DOCTOR OF PHILOSOPHY

in Information and Computer Science

by

Karen Ruhleder

Dissertation Committee:

Professor John Leslie King, Chair

Professor Susan Leigh Star

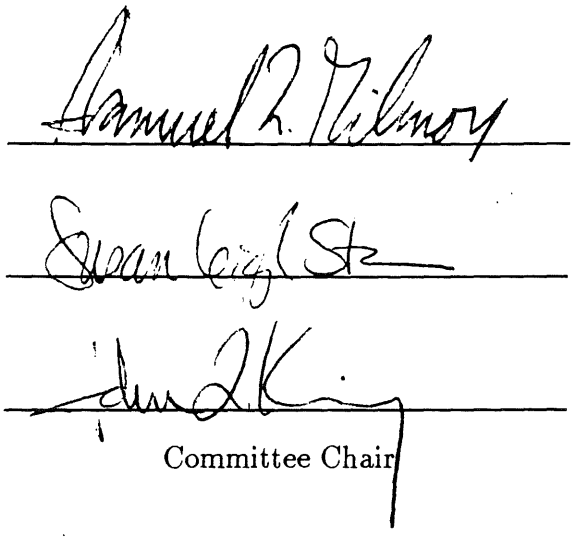
Professor Samuel L. Gilmore

1991

The dissertation of Karen Ruhleder is approved,

and is acceptable in quality and form

for publication on microfilm:



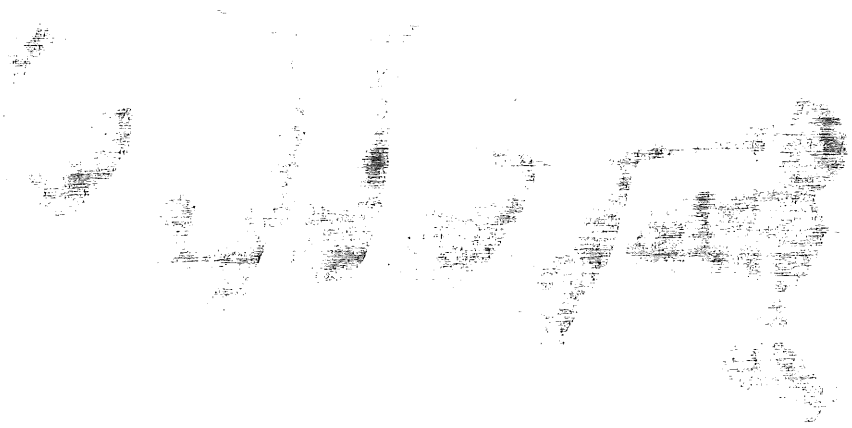
Committee Chair

University of California, Irvine

1991

Dedication

To John... and The Cat From Singapore



Contents

Acknowledgements

In the course of completing my graduate studies and creating this document, many wonderful people have touched my life. It would be impossible to list them all, lest the acknowledgements turn out to be longer than the dissertation itself! I would, however, like to give special thanks to just a few of them.

First, I would like to thank the many anonymous individuals— classicists, tool developers and others— who gave so freely of their time to contribute to this dissertation.

> in freta dum fluvii current, dum montibus umbrae
> lustrabunt con vexa, polus dum sidera pascet,
> semper honos nomenque tuum laudesque manebunt,
> quae me cumque vocant terrae. (Virgil, *Anaeid*, bk. I, l. 607–610)

I owe an especially deep debt of gratitude and appreciation to the members of my dissertation committee. John King, advisor, mentor, and friend— without you this work would have never come to fruition. Leigh Star has also been both mentor and friend, and I am grateful to her encouragement and advice. And thank you, Sam Gilmore, for all your patient help and thoughful suggestions. I have been richly rewarded by working with you all. And Special thanks to Luci Berkowitz who, as the committee member for my Advancement to Candidacy, sparked the whole idea in the first place.

I also owe a great deal to the members of the (extended) CORPS group, students and faculty, formal and honorary, for their feedback and encouragement. These include Jonathan Pine Allen, Werner Beuschel, Geof Bowker, Gunnar Christensen, Debbie Dunkle, Julian Feldman, Vijay Gurbaxani, Rogers Hall, Suzanne Iacono, Rob Kling, Ken Kraemer, Jeanne Pickering, Alladi Venkatesh, Nick Vitalar, and Kären Wieckert. And thank you also to Joan Fujimura. You have been all been exceeding generous with your time and energy over the years, and your comments and feedback have been invaluable to this large undertaking, and other smaller ones. I am also grateful to other members of the ICS faculty, staff, and student community who have encouraged and supported me along the way.

Many heartfelt thanks to Lara Ruffolo, who is Wise and True, for her steadfast friendship and support; and J. Stephen Tittle, whose most remarkable wit has enlivened many a moment. Thanks to Michael Payne, "dial-a-grad," for the many Latin and Greek questions he helped me with, and to his little friend, Carmen Lacertae; to Josette Hatter and April Love, women of vision; to two very special friends, Niels Bjorn-Andersen of Copenhagen, and *Dr.* Donna Brent of Albany, N.Y.; and to all the many wonderful people here at UCI and in Verano with whom I have sailed, danced, sung, traveled, and discussed in great detail the mysteries of the universe and the inherent evil of graduate school. Lastly, I wish to thank my parents,

Kate and Karl-Heinz Ruhleder; my sister, Kathleen Ruhleder; and my grandmother, Susanne Rusch; for their constant loving support. There are many others to whom I owe a sincere debt of gratitude for their help and encouragement over the years. You shall always be remembered.

Curriculum Vitae

Address (as of July 1, 1991):

Department of Decision and Information Sciences
College of Business Administration
University of Houston
Houston, TX 77204–6765

Education:

1990: Ph.D. in Information and Computer Sciences
Department of Information and Computer Science
University of California, Irvine
Dissertation Topic: Impact of Computerization
Advisor: Professor John Leslie King

1987: M.S. in Information and Computer Science
1984: B.S. in Information and Computer Science, *summa cum laude*
Department of Information and Computer Science
University of California, Irvine

1984: B.A. in German, *summa cum laude*
Department of German
University of California, Irvine

Honors and Fellowships:

Dissertation Fellowship (Fall 1990)

Faculty Mentor Fellowship Program (Spring–Summer 1988)

Graduate and Professional Opportunity Program Fellowship (1985–86 academic year)

University of California Education Abroad Program Study Grant (1983)

Phi Beta Kappa, junior year (1982)

Experience:

1. As of July 1991: Assistant Professor, Department of Decision and Information Sciences, College of Business Administration, University of Houston, Houston, TX 77204–6765.
2. Spring 1991: Instructor, Department of Information and Computer Science, University of California, Irvine.

3. 1986–91: Graduate Student Researcher, Department of Information and Computer Science, University of California, Irvine.
4. 1985–91 (intermittent): Teaching Assistant, Department of Information and Computer Science, University of California, Irvine
5. January–September 1985: Systems Analyst, MAI Basic Four, Tustin, CA.
6. January–August 1983: Software Developer, American Dade, Costa Mesa, CA.
7. Summer 1982: Systems Analyst, Digital Research, Sierra Madre, CA.
8. Summer 1981: Intern, Nixdorf Computer AG, Paderborn, West Germany.
9. January 1980–September 1980: Programmer, Educational Technology Center, University of California, Irvine.

Papers:

Karen Ruhleder and John Leslie King (1990), "The Academic Collaboratory as a Bridge Across Space, Time and Social Worlds," *Hawaiian International Conference on Software Systems* (refereed).

John Leslie King, Kenneth L. Kraemer, and Karen Ruhleder (1989), "Forecasting, Policy Making and Technology: An Uneasy Alliance?" submitted to *Informatization and the Public Sector.*

Karen Ruhleder (1989), "Environment and Action Explanations for Understanding Technological Innovation," graduate survey paper.

Karen Ruhleder, John Leslie King, Deborah Dunkle, and Kenneth L. Kraemer (1987), "The Efficacy of Software Engineering Methodologies: An Empirical Study in Municipal Corporations," *Technical report 88-02, UC Irvine*, submitted to *Informatization and the Public Sector.*

Presentations:

"Information Technology and the 'Re-shaping' of Work Patterns and Work Packages," invited presentation, Graduate School of Management, University of California, Los Angeles, January 31, 1991.

"The Ecology of Black Boxes in the Workplace: The Repackaging of Work Processes Through the Use of Information Technologies," Fifteenth Annual Meeting of the Society for Social Studies of Science, Minneapolis, MN, October 19–21, 1990.

"The Package *Is* the Technology: Social and Organizational Perspectives on the Development and Diffusion of Computer-Based Research Tools," Fourteenth Annual Humanities and Technology Conference, Atlanta, GA, October 18-19, 1990.

"Information Technology and Transformation of Work," workshop for early career investigators, sponsored by the Social Science Research Council, Washington D.C, 1990.

"Information Technology as an Instrument of Social Transformation," Graduate School of Business Administration, Harvard University, December 1989.

"The Computerization of Classical Scholarship: Social Transformation via Information Technologies," Fourteenth Annual Meeting of the Society for Social Studies of Science, Costa Mesa, CA, November 16–18, 1989.

"Information Technology and Cooperative Work in National Legislative Agencies," Doctoral Consortium, Special Interest Group for Computer-Human Interface, Association for Computing Machinery, April 1988.

Professional Activities and Departmental Service:

Local Arrangements Committee Member, Fourteenth Annual Meeting of the Society for Social Studies of Science, 1989.

Reviewer, *Information Systems Research.*

Student Representative, Department Graduate Admissions Committee, 1987–88.

Professional Associations:

Association for Computing Machinery

Association for Women in Science

Computer Professionals for Social Responsibility

International Society for the History, Philosophy and Social Studies of Biology

Society for the Social Study of Science

Abstract of the Dissertation

Information Technologies as Instruments of Social Transformation

The Computerization of

Classical Scholarship

by

Karen Ruhleder

Doctor of Philosophy in Information and Computer Science

University of California, Irvine, 1991

Professor John Leslie King, Chair

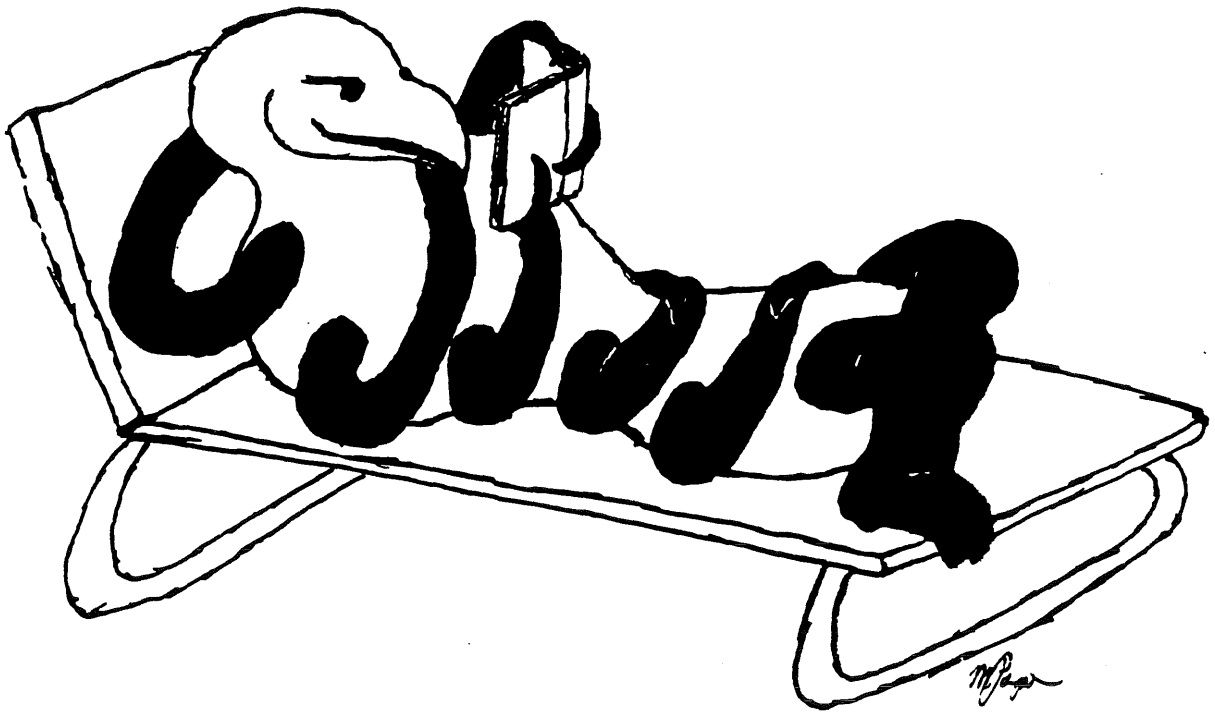
Computer-based technologies are often seen as instruments that effect radical transformation within workplaces; these transformations are expressed through utopian or dystopian visions of empowered knowledge workers or electronic sweatshops. Visions, however, do little to examine the evidence for and the nature of such transformations. In what ways do new computer-based technologies re-form and re-shape the nature, stucture, and organization of work? In particular, how do these technologies affect a domain of work which is abstract in nature and consists of the evaluation and amalgamation of many diverse information sources?

This dissertation reports on an empirical study of the impact of information technologies on a specific class of knowledge workers, classical scholars. My goal is to understand the phenomenon of change due to increased use of information technologies from the point of view of the members of this social world. In order to do this, I will follow the procedures for

data collection and analysis of the grounded theory approach as developed by Anselm Strauss and his associates. I employ the social worlds perspective as an organizing framework.

In subsequent chapters, I consider the diffusion of a particular set of computer-based research tools within the discipline and subsequent changes to individuals' work patterns, task definition and interactions within and without the discipline. I further evaluate changes in the accessibility of information and the attendent impact on social and organizational structures. Finally, I describe the emergence of electronic communities and new domains of work as information and communication technologies become more prevalent.

computera virumque cano...



Chapter 1
The IT "Revolution"

> We live in spectacular but very uncertain times. ...Many ages in the past have shown great promise while facing great difficulties, yet our age is perhaps unique in that its problems and its promise come from the same source, from the extraordinary achievements of science and technology. (Bolter 1984)

Information technologies are having a profound effect on the way we live, work, and interact with others. Since the advent of low-cost personal computing in the early 1980's, these technologies are moving into our homes, workplaces and schools in unprecedented numbers. The university provides us with one excellent example of the rapid adoption and use of computing technologies. Most students now own a word processor; for those who don't, many universities now provide rooms of shared PC's or Macintoshes for student use. Similarly, professors are using computers to help them both in teaching and research. In some cases, they have merely computerized previous tasks; for others, new technologies have opened up research questions that were previously unaccessible. As more computing power appears in the workplace, both on the campus and off, increasing numbers of people want to know: *to what effect?* How will computers change the way we live, think and work? Will they fit into existing organizations, or will they dramatically alter the institutions within which we have grown up? And what trends lie ahead?

This dissertation contributes to answering these and similar questions. It consists of an empirical study of the impact of information technology on one domain of work, classical scholarship. It considers the diffusion of a particular set of computer-based research tools within the discipline; the subsequent transformation of the nature of the work; changes in individuals' work patterns and interactions; and the restructuring of the social world of classicists as information and communication technologies become more prevalent. Individually these changes range from the minor to the dramatic; collectively, they constitute a dramatic and documentable transformation in the social world of classical scholarship.

In this chapter, I consider briefly some current dialogues on the transformational aspects of computing, and describe the various venues which academicians have chosen for their analyses of technological impact. I discuss some of the issues raised in empirical studies of the impact of information technologies, and describe where my work fits in relation to

previous approaches. I close with a summary of the subsequent chapters of the dissertation and of the issues which will be explored in greater detail within them.

1.1 Steppin' Lively into the Information Age

I started out by stating that "Information technologies are having a profound effect on the way we live, work, and interact with others." But how? We "know" a great deal about the effect of information technologies through anecdotal evidence, personal or second-hand; through visions expressed in fiction and in the popular media; and through the use of metaphors to explain and define the technological impact. Anecdotal evidence sometimes presents us with the most direct and immediate understanding of technological impact.

Consider the document you are reading now— my dissertation. When my father wrote his dissertation, he literally wrote it out by hand. He then would type up drafts on a manual typewriter, banging away at the keys, typing and retyping until things were pretty much as he wanted them. His notes were on paper, copied out by hand from books borrowed and often used in the library. If he wanted to talk with someone, he would make an appointment and meet them somewhere. If he wanted to get in touch with someone farther away, he would write or type out a letter and mail it to them, and they would respond in the same way. When I talk about my dissertation with my parents, they recall not so much the content of his dissertation as the many particulars about the circumstances under which it was written, including the pride of owning a typewriter, the tedium of the actual typing, and the many times my mother was dragged out of bed at 2 A.M. to listen to a new idea my father needed to discuss with someone.

My dissertation has been crafted quite differently. I write it on a computer; at any moment, I can format and print whatever I have ready. I correspond electronically with colleagues both far and near. Of course, I still write things in longhand, and I still talk to people in person, but many of my day-to-day tasks are carried out "on line." Many of my notes are stored electronically, and some of my data comes from on-line bulletin boards, mailing lists, and personal electronic correspondence. My first act upon reaching the office is to "fire up" the computer and Lo! morning becomes electric. My work is at once more portable, since I can access my files remotely and mail them out globally; and less portable, since I am far more dependent on physical equipment and a technical infrastructure than my father ever was. With the help of this infrastructure, I can visit the library without leaving my desk. And I am linked to an international community of colleagues via not only the telephone but electronic mail and FAX machine. Within an hour, I can trade messages back and forth with someone on the other coast, or even in Europe. The world accessible to me literally at my fingertips is far broader than that of my father.

In the forty-odd years between the time my father wrote his dissertation and the time I am writing mine, profound changes have taken place not only in the way that documents (such as dissertations) are produced, but in the way that information is stored, manipulated, and transmitted. As new information technologies have become more prevalent, they have altered the kinds of information available; the costs associated with its collection, use and maintenance; and the politics of access. New technologies for communication have both opened and closed worlds of social interaction. Entire new industries have emerged while others have faded away. Some of these changes are reflected in the above example; they and others will be elaborated upon in the following chapter. Few would deny that computing has had at least some impact on their lives.

How can we document and understand the attendant changes— and, in particular, how can *I* document and understand the changes taking place within the social world of classic scholarship? Below, I consider some ways in which a variety of individuals have tried to go beyond haphazard and anecdotal evidence, and have begun to identify patterns, to outline critical issues, and to chart the dimensions of technological impact. I draw on the lessons these studies provide to articulate the approach I have taken in this empirical study of the computerization in classics. I will continue to draw on their conclusions as I discuss the impacts of computerization on the social world of classical scholarship.

1.2 Information Technology and Change

> We are in the midst of an information technology revolution, but the human, organizational and social factors shaping this revolution have been scarcely analyzed and they are as yet imperfectly understood. (Forester 1989)

Forester (1989) introduces a collection of essays on information technology, organizations, and people by stating, "Clearly, something very important is happening to society with the influx of IT, but we don't as yet fully understand what it is." Even before serious empirical work was undertaken to address these issues, speculation about the impacts of these and other technologies has run rampant. Below I examine both some of the rhetoric surrounding computing and technical innovation in general, and the different venues and approaches chosen by academic researchers in evaluating the impact of emerging technologies.

1.2.1 The Rhetoric of Social Transformation

> Would you realize what Revolution is, call it Progess; and would you realize what Progress is, call it Tomorrow.
>
> — Victor Hugo, *Les Misérables*

Computing technologies have often been cast as instruments of radical social transformation, whether in the popular media or in scholarly research. Aldous Huxley's *Brave New World* (1932) and George Orwell's *1984* (1950) have shaped past generations' visions of possible futures. Movies such as Charlie Chaplin's *Modern Times* make manifest our fears that thinking machines will become our masters, while *Starwars'* robots C3P0 and R2D2 assuage those fears by their portrayal of Machine as loyal and helpful Friend. Such presentations in popular forums often form the only view of technological potential available to the average person (Mowshowitz 1977, Sullivan 1983).

But what do we mean by this often ill-defined notion of *social transformation*? One visionary describes it as follows:

> Old ways of thinking, old formulas, dogmas, and ideologies, no matter how cherished or how useful in the past, no longer fit the facts. The world that is fast emerging from the clash of new values and technologies, new geopolitical relationships, new life-styles and modes of communication, demands wholly new ideas and analogies, classifications and concepts. (Toffler 1980)

Others anticipate radical transformation to "the contours of our working life" which will strip away our former values, conventions, and institutions, and replace them with an entirely new system of social organization (Howard 1985).

Certainly computing technologies are not the first technologies to be seen as instruments of such radical transformation. The Industrial Revolution is often used as a point of departure for discussing the impacts of a similar "Information Revolution." Kranzberg (1985) writes that it involved not only an explosion of technical innovation, but also marked "a truly revolutionary transformation of society because it changed *where and how people worked, lived, thought, played and prayed*" and concludes that changes of a similar magnitude are taking place in the "Information Age."

This new age, however, is to be far more dramatic. Even single innovations, such as hypertext, will change civilization by changing our relationship to the written word (Nelson 1987). Moreover, our very definition of ourselves may be transformed by the advent of the computer age (Bolter 1984, Turkle 1987). Whereas the ancients viewed themselves as clay vessels animated by divine breath, and the Cartesian view compared the human body with a clock, the computer now provides us with powerful metaphors to view our own selves. The computer has given us "a new definition of man, as an 'information processor,' and of nature, as 'information to be processed' " (Bolter 1984).

1.2.2 Floating Cities or Police State?

> Is this new world for everyone? ...What do we lose from the old world as we gain the new? (Allor 1987)

If changes do occur, where will they lead us? Two dominant visions, utopian and dystopian, are particularly evident in both fiction and academic research.[1] They seek to demonstrate that technological progress creates dramatic social and organizational changes that will catapult us either into an electronic heaven-on-earth or plunge us into a technological hell.

Utopian visions promote new technologies by offering brilliant possibilities and opportunities to those able to grasp and make their own the essence of a new age (eg. Toffler 1980, Fuller 1981, Inose and Pierce 1984, Giuliano 1985). They paint glorious pictures of floating tetrahedral cities, virtual offices, and intelligent environments, while citizens will form a new "electronic commonwealth" with greater opportunity for participation (Abramson and others 1988, Lenk 1987). Proponents of a utopian view frequently talk about technologies in terms of future potentials and often dismiss contemporary technologies and their limitations (Kling and Iacono 1988).

Others warn us of alienation, loss of control, and human exploitation by an antisocial machine (eg. Ellul 1964, Mumford 1964). New technologies in the private sector, they say, lead to deskilling (Braverman 1974, Howard 1985) and the creation of a technical elite (Kraft 1987). Meanwhile, greater governmental control over information limit the free exchange of information and ideas in the United States (Shattuck and Spence 1988), leading to the development of an electronic police state (Burnham 1983). While many of their fears are often empirically grounded, these "dystopians" fail to provide a coherent and compelling alternate conception of society and the role which technology should play within society (Kling and Iacono 1988).

1.2.3 The Question of *Determinism*

> "Momma, cars don't behave, they are behaved upon."
>
> — Alfred Uhry, *Driving Miss Daisy*

A related issue is the relationship between technology and social change. Do we— humans— have the power to *direct* change, or are the impending changes beyond our personal or collective control? Assuming for the moment that technological artifacts do, indeed, have the

[1] The rhetoric of technological impact relies heavily on expression through dichotomy: optimism vs. pessimism, technological determinism vs. human choice, revolution vs. evolution, radical discontinuity vs. traditional incrementalism. See Forester (1989) for a discussion of these various conceptual frameworks or, as he terms them, the "somewhat simplistic devices which we use to clarify the different positions taken."

power to effect social transformation on any scale, does technology *cause* or *enable* that transformation? Proponents of dystopian visions often subscribe to the notion of *technological determinism*— what Winner (1977) terms the idea of *autonomous technology*— the belief that "somehow technology has gotten out of control and follows its own course, independent of human direction." Ellul writes that "Man, in modern societies, is not situated in relation to other men, but in relation to technique; .... Technique is independent of the human being, who finds himself naked and disarmed before it" (Ellul 1964). This view of technology-out-of-control is not limited to critics of computing. Heisenberg (1958), for instance, when speaking of his own work in quantum physics, concludes that he has contributed to the rise of an uncontained historical force, which "has gone far beyond any control through human forces."

In contrast to technological determinism, others see social change as a consequence of *human choice* or *social determinism.* Their approach to analysis and design sees technological artifacts not as discrete objects, but rather as embedded within a larger social system (Brooks 1980, Hughes 1983). System and technology are intricately linked in terms of form, symbol, and use (Kling and Iacono 1988), and just as the technology may shape a system, so the system may shape the technology in a process of continued linkage and interdependence (Raben and Enke 1982).[2]

There is, of course, a limit to social determinism. For instance, while it is certainly true that computing technologies in the abstract are extremely malleable, it is equally true that at some point a specific artifact ceases to be malleable, and it becomes easier for the social and organizational structures within which it is embedded to be changed in order to accommodate the artifact, than for the artifact to be reconstructed once it is in place (Kling and Scacchi 1982, Law and Whittaker 1988). Winner (1980) refers to artifacts as having politics in this sense, as they can be designed to embody and achieve social and political goals.[3]

[2]Perhaps the extreme articulation of the "social determinism" position would be the "tool view," in which the link between artifact and builder is entirely one-way. The tool view considers artifacts to be completely neutral and completely powerless except as consciously employed by human beings. One developer of a "scholar's workstation," for instance, writes, that "the computer is compatible with a whole variety of human needs and interests. It's a tool that people can use in any way they want" (Raben 1985). Guns don't kill ....

[3]As an example he cites Robert Moses' design of 9' high overpasses for New York's parkways. Moses' openly stated goal was to keep 12' high busses off of the parkways, thus effectively limiting access to his widely acclaimed state park at Jones Beach to the predominantly white automobile-owning middle- and upper-class whites (Caro 1974). Winner would argue that the politics were *embedded* in this artifact. Moses is also known for destroying "unsightly" ethnic neighborhoods to make room for his parkways.

1.3 Empirical Studies of Computing

> ...[T]here is almost no middle ground of rational discourse, no available common language with which persons of differing backgrounds can discuss matters of technology in thoughtful, critical terms. Conversations gravitate towards warring polarities and choosing sides. (Winner 1977)

Extreme visions of technological utopias and dystopias help to fire our imaginations and allow us to explore the forms and boundaries of interactions between social and technological systems. They provide, however, unsatisfactory explanations of the dynamics and directions of change and offer no concrete evidence to support their claims. Mesthene calls both extremes "unhelpful views about technology" which while containing grains of truth, are far too one-dimensional to aid in understanding the complex intertwining of and blurred boundaries between technological artifacts and social systems (Mesthene 1969). Recent empirical work has begun to provide us with a more finely-grained set of answers to questions of the directions and dimensions of technological impact. One distinct approach to research in this area has been carried out by members of the Irvine School (Kraemer and King 1990), with its focus on the social and organizational implications of information technology. A cornerstone of the Irvine School approach has been the application of both multiple perspectives and muliple ressearch methods. In particular, members are known for a combination of survey research and in-depth case studies. I draw on this and other work below.

1.3.1 Information Technology in the Workplace

> O, how full of briers is this working-day world!
>
> — Shakespeare, *As You Like It*, I, *iii*, 12.

The workplace frequently provides a venue for the analysis of technological impact. Researchers turn to the workplace for several reasons. From a pragmatic standpoint, this is where the technology is most prevalent and, hence, most available for study. Information systems play an increasingly important role both public sector organizations (Abramson and others 1988, Dutton and Kraemer 1985, Frantzich 1982) and private sector organizations (Buchanan 1985, Hirschhorn 1984, Gershuny and Miles 1983). And with the advent of inexpensive personal computers in the early 1980's even small businesses can now afford a PC with software to accommodate tasks ranging from customer database maintenance to inventory management.

Mere pragmatics aside, work also plays a vital role in our lives as well as consuming a major portion of our time. The typical work-week of a wage earner consists of 40 hours, and

many people work more hours than that.[4] More importantly, *work*, in our (western, industrial) society, plays an integral part in self-definition. To ignore the impact of a technology on the workplace would be to ignore its impact on a central component of the lives we construct for ourselves. On this note, let's consider some empirical approaches to understanding the role and impact of new computing technologies on our worklives.

There has been a wealth of speculation about the future of work in the age of computerization. One set of commentaries postulates changes to the configuration and character of work (Boddy and Buchanan 1984, Braverman 1974). Drawing again on the rhetoric surrounding transformation, these visions have varied from the concept of a liberated global village of artisans (Toffler 1980) to the dismal prospect of the electronic sweatshop (Garson 1988, Perrolle 1986). Questions about the changing character of work are closely linked to questions about organizational structure and function. Some anticipate the deskilling of workers and the increase of control over workers (Braverman 1974, Howard 1985, Shaiken 1985, Zuboff 1988), while others argue that the nature of IT actually increases the dependence of managers on skilled workers (Hirschhorn 1984).[5] While these conclusions have been drawn primarily from studies of clerical and manual work, Perrolle (1986) speculates that deskilling and routinization might extend to intellectual work as well. While one dominant theme has been the "office of the future" (Giuliano 1985), a paperless office in which employees will have far greater flexibility over their work through increased use of information technologies, others anticipate a far more mixed set of changes. For example, in an analysis of changes in the labor force with the transition from an agricultural economy to a service economy with a strong information sector, Kling and Turner (1991) challenge the typification of "information workers" as professionals. Instead, empirical evidence demonstrates that the dominant jobs, growing most rapidly both in absolute and relative terms, are clerical positions. Overall, empirical results often present a far more mixed picture than anticipated (Attewell and Rule 1984).

Other commentaries focus on a different level of social activity, the structure and function of organizations (Child and Mansfield 1972, Whisler 1970, Markus and Robey 1988). For example, there has been an extensive discourse over the effects of computerization on centralization or decentralization (Kraemer and Dutton 1979, George and King 1991), with some arguments going so far as to claim the pending end of hierarchy itself (Cleveland 1985). Vitalari (1990) examines a new organizational structure which has emerged with the advent of personal computing: distributed work arrangements or *type-D* organizational structures. While not implying causality, he does state that "An analysis of the use of information technology in the implementation of distributed work arrangements strongly suggests that certain types of distributed arrangements would not exist or would not be feasible in the absence of key informational technologies" (Vitalari 1990, p. 116). While some anticipate the flattening of organizations due to increased use of IT for communication within firms, work

[4]There is also "invisible" and unpaid work, done primarily by women, such as caring for children or the elderly, working as volunteers, etc. (Daniels 1987, N. Glaser 1987, Stasser 1982); but that's another topic.

[5]Many of these are at least partially marxist-based analyses.

by Gurbaxani and Whang (forthcoming) indicates that when IT is used to reduce internal coordination costs, both vertical and horizontal growth may be advantageous.

Much of this dialogue is centered around questions of control— over information, over decision making, over financial resources. From this standpoint, Beninger (1986) argues that information technologies themselves are not revolutionary devices, but are merely the "latest installment" in an on-going control revolution and a tool in the development and rise of the bureaucracy in the 19th century. A closely allied concern is privacy: with control over information, organizations gain power over individuals. Various books raise questions about the role computing will have in reinforcing or restructuring bases of power and control over individuals and groups (Burnham 1983, Rule and others 1980, Shattuck and Spence 1988).

One of the great debates of the 1980's has been whether office automation has really made business organizations more productive. Almost 40 percent of U.S. capital spending goes to information processing systems— has this helped or hurt the "bottom line"? (Harris and others 1987, ICIT 1988). In many cases, the productivity gains expected from computing have brought no overall improvement (Bowen 1986). Reasons for this include the often high start-up costs associated with computing both in capital expenditure and in training costs. For this reason, some anticipate a delayed reaction, citing similar experiences during the British and U.S. industrial revolutions (Franke 1987). In some cases, the failure of systems to achieve the desired results may be rooted in organizational and managerial issues. Successful deployment of IT may require a reconfiguration of work tasks and flow (Long 1987), and careful (re)designing of organizational structures to realize competitive and strategic advantages through new information and communication technologies (Keen 1988, Keen 1991). It may also rely heavily on "people-centered" management of technology, requiring the adoption not only of innovative technologies but of innovative work practices (Bessant and Chisholm 1989, Hoerr and others 1989).

Finally, one question that frequently goes *un*asked is: to whom is the work addressed, and who will benefit from the analysis? In a recent paper, Kling (1990) identifies five common genres of social analysis, of which he predicts that utopian and anti-utopian analyses are most likely to dominate both popular and professional discourse in the 1990s. He calls instead for more empirically oriented analyses of computerization.[6] These tend to portray a much more ambiguous world with subtle distinctions. Unfortunately, while these discourses are more robust and more firmly grounded in evidence, they are without the same rhetorical power to capture the attention and imagination of the mass media press and technological

[6]Kling (1990) delineates three genres of empirically oriented analyses, including *social realism*, which uses empirical data to examine computerization as it is actually practiced and experienced (and may be journalistic in nature); *social theory*, in which analysts seek to explicitly develop or test concepts and theories that transcend specific situations; and *analytical reduction*, in which scholars organize their investigations by working within tightly defined conceptual frameworks using a few key concepts (if using a quantitative approach, they operationalize all of their key concepts into variables).

communities. In particular, they are far less commonly seen and read by computer professionals and policymakers than the utopian/anti-utopian analyses, leading Kling to comment that, "It is ironic that computing— often portrayed as an instrument of knowledge— is primarily the subject of a popular and professional literature which (sic) are heavily weighted towards the genres whose knowledge claims are the most suspect."

1.3.2 Technological Adoption and Diffusion

> There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.
>
> — Niccolò Machiavelli, *The Prince* (1532)

One major focus of study has been the adoption and diffusion of new technologies. *Diffusion studies* seek to model the process by which an innovation or set of innovations is adopted by individuals or organizations.[7] Most diffusion studies focus on one specific innovation, whether technical, structural or procedural. *Organizational innovation research* studies the mechanisms of and factors involved in the adoption and routinization of computing technologies in the workplace. This body of research has considered the factors of organizations and features of innovations which facilitate or inhibit adoption and the characteristics of early, late, and middle adopters. It has evaluated the utility of various communication channels for learning about new innovations (Fidler and Johnson 1987), proposed models of user-resistance to innovations (Markus 1984, Johnson and Rice 1987), and extended the diffusion/adoption model to include institutionalization of the innovation after its initial adoption (Yin 1981, Kraemer and others 1988).

Some researchers ask what *motivates* adopters to undertake what can be a costly and disruptive endeavor. Computers may be seen as a means to "rationalize" decision-making or streamline work processes; new technologies such as automated manufacturing tools may be considered essential to establish or maintain a competitive edge in the marketplace (Dean 1987). In some organizations, the introduction of a new technology serves also— or primarily— as a means of also introducing "social" innovations through new work structures or processes (Iacono and Kling 1984). Information technologies may even have more symbolic than actual value; in the public sector, their use can enhance the standing or prestige of organizations in the eyes of funders (Downs 1976, Feller and others 1974, Gray 1973, Kling 1978, Mohr 1969). Different people within the same organization may have different, sometimes even opposing reasons for using new technologies (Kraemer and others 1987). In

[7]Rogers (1983) offers a comprehensive review of the literature and various proposed models. See also Ruhleder (1989) for a discussion of a framework for understanding the diffusion literature based on an environment/action framework.

both the design and deployment of new technological artifacts, non-technical, non-scientific factors may exert a greater influence than technical, scientific considerations.

Research on organizational innovation rarely questions the appropriateness of the innovation(s) under study within a given organizational context (this shortcoming is termed "pro-innovation bias" by Rogers and Shoemaker 1971). Studies also treat an innovation as a discrete entity placed into a closed system, rather than proposing a model of interlinkage or mutual influence between innovation and the adopting community or organization. This second assumption, coupled with a heavy reliance on survey research and statistical analysis (Ruhleder 1989), restricts the ability of these studies to answer questions about technological innovations as instruments of social change.

1.4 Overview of the dissertation

Below, I outline both the goals and the organization of the following chapters of this work. The dissertation addresses a number of issues raised above and makes a useful contribution to the quest for answers in these on-going debates. It evaluates the impact of information technologies on an exemplary line of "knowledge workers." As a basis for the analysis, it describes the complex social and organizational phenomena involved in the generation of classical scholarship. It examines the *reciprocal* influence between the organization of work and the manner in which technical artifacts are developed and used to support that work. And it assesses how computerization alters both the structure and character of individuals' job activities, and the ways in which individuals interact with others in carrying out their work.

The goal of the dissertation is to examine in rich detail the actual effects of computerization on a narrowly defined domain of work, and to isolate those features which are generalizable to other settings. I seek to understand:

- how the work of classical scholarship work is organized;
- why information technologies are important to this work;
- how they are being introduced into the workplace;
- and what changes they are effecting.

In organizing this dissertation, I have sought to accomplish two purposes. First, as not all individuals reading this dissertation will be familiar with classical scholarship as a discipline, I have tried to very quickly introduce the reader to key issues, goals, methods and tools used by classicists. Secondly, as the reader becomes more aware of various aspects of, or within classical scholarship, I have tried to present some of the changes that are occurring or may

occur through increased computerization, based either on data from interview sources or secondary sources, or through comparisons with other past technological shifts either within classics or within other domains of work.

Chapter 2: The Organization of Academic Work Various approaches have been suggested as a means of describing the organization of academic departments and disciplines. These include *loosely-coupled organizations* (March and Olsen 1975, Weick 1976), models of departmental organization (Campbell 1969, Graff 1987), and *invisible colleges* (Crane 1972, Merton 1957, Price 1965). I present the *social worlds perspective* as providing an analytical framework that incorporates and elaborates upon the diverse features of the above organizing perspectives. I close with a description of the methodology I used for data collection and analysis.

Chapter 3: Classical Scholarship and Humanities Computing. Classics as a discipline is exceptionally stable even while classicists have been among the first within the humanities to embrace new computing technologies in their work. I explore the history of the discipline and the conventions that guide the organization of work, and develop a picture of how classicists view themselves and their work. The chapter includes a discussion of the problems they face in carrying out that work. It also describes briefly some of the "history of computing" both in classics and in the Humanities more generally.

Chapter 4: Development of Tools and Techniques in Classics In order to carry out their activities and address questions central to the discipline, classical scholars have developed an array of tools and techniques to support their work. These include "traditional" tools in book form and, increasingly, they include computer-based tools. Some of these tools are developed specifically for classicists, or even for a small group of specialists within classics, while other applications are malleable enough to be tailored for specific individuals. I propose the use of a *package* or *web* metaphor for understanding the "fit" between particular tools or types of tools and the larger domain of work (Kling and Scacchi 1982). "Successful" tools have not merely addressed critical needs within the discipline; they have also either supported established conventions or social arrangements within classics, or have developed alternatives to them that have become legitimized within the social world.

Chapter 5: The Thesaurus Linguae Graecae As a case in point, I describe one particularly successful tool, the *Thesaurus Linguae Graecae* (TLG), an electronic databank of Greek literary texts (Brunner 1987, Brunner 1988). I trace out its history, its relationship to other tool develop projects within classics, and the fit between the TLG and work of classical scholars. The extensive development of a "TLG package" has enabled it to become a critical tool for classicists and to form an important standard for other tool building efforts.

Chapter 6: Change in Work Processes and the Nature of Work. The increased use of information technologies has effected both work activities and the nature or content of the work. The impact of other shifts in media have already demonstrated the potential for change via the introduction of innovative media. Prior work supports the hypothesis that new media can profoundly alter the way that people incorporate various forms of information into their work. The artifacts that classical scholars use in their work both embody assumptions about and activities essential to the work process. These artifacts are reconstructed as they are transferred to new media, and these changes are reflected in the work process. New information technologies effect the creation of scholarly products, and introduce new divisions of labor between scholars and publishers. And finally, new technologies require both individual scholars and the scholarly community as a whole to develop new forms of expertise.

Chapter 7: New Patterns of Interaction Information technologies have also altered the relationships between classical scholars and other individuals, both within and without the established social world. Increased opportunities for electronic communications have direct consequences for both storage and retrieval of information and for communication between members of the social world. Electronic mailing lists and bulletin boards, for instance, provide opportunities for new "electronic communities" centered around specific topics or areas of interest (Sproull and Kiesler 1986, Finholt and Sproull 1988, Barlow 1990). On another level, developing interests in humanities computing are spawning a new subworld which brings together humanists and technologists. What twenty years ago was viewed as the domain of a few eccentrics is now struggling to emerge as a viable area of scholarly research.

Chapter 8: Quo Vadis? Finally, I ask if information technologies have transformed the work of classical scholars in any meaningful or appreciable way. On the one hand, the kinds of questions which classicist address have changed little if at all; and the organizations within which they conduct their inquiries— departments, universities, and libraries— are still standing. On the other hand, new technologies have opened up novel research opportunities for individual scholars, caused individuals to restructure their work patterns, triggered the emergence of new infrastructures to support scholarship, and transformed and expanded scholarly interactions and communications. After summarizing some of the changes taking place in classics, I reconsider the question and definition of "social transformation" with respect to both classical scholarship and other domains. I close the chapter by considering future research suggested by issues raised in this dissertation.

1.5 Final Words Before Plunging In

To return to the central concern of this study, we seek to understand the impact of information technologies on a particular domain of work. Perhaps the most fruitful line of inquiry leads us to think not solely in terms of organizations or structure, nor solely in terms of individuals or workers, but rather to explore the realm of *meaningful interactions* between individuals and structures. These come "bundled together" in various ways— as groups, professions, teams— and can be understood within the context of social worlds analysis. By means of continued empirical analyses we, members of a varied and interdisciplinary research community, will more fully develop our understanding of the mechanisms and dynamics of technological impact and social change. The following pages contribute in their own small way to this collective undertaking.

Chapter 2

Disciplines and Social Worlds

> 'Mongst all these stirs of discontented strife,
> O, let me lead an academic life;
> To know much, and to think for nothing, know
> Nothing to have, yet think we have enow.
>
> — Joseph Hall, *Discontent of Men with Their Condition*

The domain within which we investigate the impact of computing is *classical scholarship*, an academic discipline. One element of our task is to select a framework or mechanism for describing and understanding the domain. In this chapter, I review a set of approaches used to describe various aspects of academic activites and disciplinary structures. I outline the analytical framework on which I draw, the social worlds perspective, and conclude by describing *grounded theory*, the methodology which guided my data collection and analysis. The final section details the sources from which my data are derived.

2.1 Organization of Academic Disciplines

> The boundaries of disciplines are dictated not by logic but by problems, opportunities, accidents. (Gellner 1988)

Impact studies of technologies within the workplace are often not grounded in the world view of those doing they work. They are frequently drawn along formal organizational lines: by industry, by school, or by job title. These boundaries do not always make sense in the context of the work itself, nor do they always effectively take into consideration the social relationships between members both within and without the formal confines of the organization.

In academic institutions, for instance, the increasingly widespread use of personal computing by faculty members doesn't just have the potential to change their work habits in terms of writing papers. It can alter the interactions between secretarial support staff and

faculty. Coupled with electronic communications and desktop publishing packages, it can change the relationship between faculty members, journal editors, and book publishers. And it can lead to the establishment of previously unnecessary or unimportant ties with technical support staff.

Scholarship today tends to be carried out at colleges and universities by members of a faculty whose responsibilities include not only research but teaching and service as well. Academic institutions in the United States have dramatically increased in size during the past century leading to what Kerr (1964) termed the "modern multiuniversity," with tens of thousands of students, thousands of faculty members, hundreds of administrators, forming a bureaucratic umbrella for scores of schools and colleges. According to Blau,

> Academe, the grove where Plato developed his influential philosophy in discourse with disciples, continues to provide not only the label but also the romantic ideal of academic work. The image of such a small community of scholars in spontaneous intellectual intercourse without need for any administrative framework, however, is not an accurate reflection of the realities of contemporary academic life in the United States. (Blau 1973)

Blau investigates how the organization of an academic enterprise influences academic pursuits. Interestingly enough, he concludes that the bureaucratic features of academic institutions do have deleterious consequences for educational performance, but none could be discovered that had negative impacts on research performance. He suggests this is because "research can be separated from an institution's administrative machinery while education is intricately enmeshed in it" (Blau 1973). While this dissertation focuses primarily on only the "academic pursuit" side of the coin, it behooves us to keep in mind the other side— the bureaucratic side— of the "academic enterprise" as a whole.

We, however, are interested in the pursuit of scholarship. What is it that scholars *do* and how do they accomplish it? Consider some of the following excerpts from interviews with classicists and others who use classical texts or tools to support their work— and hence, use some of the tools we will be investigating. In these excerpts they talk about their work, their colleagues, and their resource needs. Their comments belie the image of the scholar, "lonely and free," and instead paint a picture of an intricately linked network of individuals working towards an often shifting set of common goals.

> I work with [a West Coast classicist], but we don't have much in common. I'm closest with people at [a mid-Western university]. I have contacts to England, Illinois. There is a triennial congress [for papyrologists]. You phone people, you send stuff. You tend to be a loner as a papyrologist because there's usually only one of you in a department. (Papyrologist)

> One of my colleagues, the editor of a journal ... uses [electronic mail] to a certain extent. I don't use it for interdepartmental mail, or even interuniversity. There

> are some colleagues on campus, one in philosophy; we send things back and forth. There's [a faculty member in the English Department], and a programmer at the computing facility. (Classicist)
>
> David Packard [of the Packard Humanities Institute] himself showed me how to do this [how do search for co-locations using the TLG]; I got it from the "horse's mouth." (Classicist)
>
> The money for the [IBYCUS computer lab] came from the University; the money for maintenance comes from the departmental budget. (Classicist)

One thing immediately apparent from these excerpts is the richness of the connections between people both within and without classics departments, and both within and without the university. The social organization of activities pertaining to research efforts does not always follow established institutional lines, but may cut across them as individuals separated by formal organizational boundaries develop or see similarities in research questions and their approaches to their work. Some of the connections in these examples stem specifically from the individuals' involvement with computing. Any framework for understanding or describing the organization of academic disciplines will have to capture the flavor of these interactions. Below I'll examine various approaches to describing academic disciplines, institutions, and interactions between their various members.

2.1.1 Loosely Coupled Systems

One way of discussing the structure of educational organizations at a very broad level is to view educational institutions as *loosely coupled systems* (Weick 1976). The concept of loose coupling appeared first in the literature on organizations in the early 1970's (Glassman 1973, March and Olsen 1975), and is intended "...to convey the image that the coupled events are responsive, *but* that each event also preserves its own identity and some evidence of its physical or logical separateness" (Weick 1976:3). Weick develops this concept through a study of high schools and colleges. We can apply this model at the level of the university as well. The coupling imagery suggests a series of building blocks that can be added to or removed from an organization without greatly disturbing either the individual blocks or the organization. We can conceive of departments forming such loosely-coupled building blocks. For instance, a classics department may be loosely coupled to a philosophy department. Each retains its own identity and separateness, yet they may be linked by infrequent, circumscribed, or weak contact, such as the occasional cross-listed class, or the use of a Greek databank located within a classics department by a philosophy professor.

2.1.2 Formation of Departments, Institutional Boundaries

The idea of loose coupling provides us with a way of thinking about the relationships of various departments to each other and to other institutional entities within the formal university structure. But how are the departments themselves organized? Gerald Graff, in *Professing Literature*, examines the institutional history of academic literary studies in the United States (Graff 1987). The formation of language and literature departments within universities took place in the last quarter of the nineteenth century, though the use of literature as an educational vehicle goes back to ancient times (Reynolds and Wilson 1974).

Pre-nineteenth century practices influenced the formation of these departments but did not provide a model for organization. The model which did emerge worked on the "field-coverage" principle, in which the department assumes itself respectably staffed once "...instructors competent to 'cover' a more or less balanced spread of literary periods and genres, with a scattering of themes and special topics" have joined the faculty (Graff 1987, p. 7). This model, of course, presumes a consensus in the discipline on what *in general* needs to be covered. Once firmly established, this model specifies a very clear division of labor which may help decrease or diffuse resistance to innovative curriculum design. If a new approach to criticism emerges, for instance, all one needs to do is add another individual to the faculty, while leaving other areas intact. Graff rather cynically derides this approach, "By organizing itself on a principle of systematic non-relationship in which all parties tacitly agreed not to ask how they might be connected or opposed, the department prevented potentially edifying conflicts from becoming part of what literary studies was about. ...[T]he myth of shared humanistic values and purposes could always be maintained" (Graff 1987, p. 9).

Campbell (1969) sees the development of formal departmental boundaries somewhat differently and more positively. In fact, he advocates organizing departments around the field-coverage principle in its purest form, and terms this the "fish scale model." Within his model, each faculty member is an "expert" in some small area, which overlaps slightly with the area of expertise of several other faculty members. In most university settings, however, he finds that reality falls short of this ideal. Instead, the "fish scales" don't overlap evenly, but rather cluster about some areas or topics, leaving others uncovered. These clusters form the "core" areas of a discipline and the gaps define between-area boundaries. Eventually, these cores, boundaries, and gaps become formalized as departments and schools.

2.1.3 Invisible Colleges

Campbell's work fits with trends in the sociology of science aimed at determining the relationship between researchers and the formation and establishment of research areas centered around common questions. It doesn't, however, address questions of communication

with members outside of these formal boundaries. Sociologists of science have used techniques such as bibliographic citation analysis to describe networks of scientific collaboration (eg. Merton 1957, Price 1965, Crane 1972). This work has led to a view of scientific research communities as "invisible colleges," specialized groups of researchers within larger scientific communities linked by a shared set of research problems and approaches. Sociologists have used similar approaches to understanding the establishment of scientific "facts"; the emergence of new disciplines; and the diffusion of new ideas, techniques, and tools within a scientific community (Kuhn 1970, Latour and Woolgar 1979, Fujimura 1988).

Under the invisible colleges metaphor, research communities can be viewed as consisting of professionals committed to the solution of a common set of problems through the application of a shared paradigm. They transcend formal organizational boundaries, and may include researchers and others not belonging to any formal academic institution. As new problems and approaches to this solution arise, new communities form which break away from established communities. Potter describes the culmination of this process in a commentary on the schism between literary criticism and literary computing, writing: "[w]e [practitioners of literary computing] publish in our own journals, give papers at our own conferences, and, for all intents and purposes, might as well be linguists as far as [noted literary critics] are concerned" (Potter 1988).

2.1.4 Commonalities Between Perspectives

Certainly rigid organizational hierarchies would be inadequate for describing many aspects of academic collaboration, sharing of data, development of new disciplines and subdisciplines, etc. These first three approaches outlined above, *loosely-coupled systems*, *field-coverage*, and *invisible colleges*, preserve different aspects of the very fluid nature of academic disciplines and even formal academic institutions. Instead, each of these approaches focuses on some domain of interest and/or interaction. Loose coupling provides an analytical mechanism for understanding the establishment of transient relationships between individuals based on temporarily shared problems or interests; the field-coverage principle or fish-scale model capture the formation of departments around problem domains; and invisible colleges capture the establishment of research-directed networks on the basis of repeated interactions between individuals.

What these three approaches fail to do, however, is to cast a broad enough net to capture all the different kinds of interactions that are required in order to carry out academic work. While loose coupling, for instance, does capture transient relationships, it does not provide a framework for discussing permanence and continuity. The field-coverage principle applies to the structure of many academic departments, but does not capture either the nature of interdisciplinary work nor some individuals' propensity to develop a set of divergent interests. Finally, the notion of invisible colleges focuses on research-based ties and, in particular, the

products of these research-based interactions. It leaves no room for other forms of interaction nor does it capture the intricacies of the process by which the products of research are brought forth.

2.2 Social Worlds as an Organizing Perspective

> Civilization ...has to do not with things
> but with the invisible ties
> that join one thing to another.
>
> — *Antoine de Saint-Exupéry*

In this section we discuss the various elements the *social worlds perspective*, and its applicability as an organizing perspective for studying an academic discipline. Before doing so, however, we examine its roots in *symbolic interactionism.*

2.2.1 Symbolic Interactionism

Symbolic interactionism looks at society as emerging from the "infinite transactions of social actors" (Rock 1979). It developed out of the Chicago school of sociology, the dominant school in the U.S. in the 1920's, and served both as an alternative to functionalism and as a critique of positivism. Its roots lie in the concept of self as articulated by Mead (1934, 1938). Three fundamental premises are: that people act towards things on the basis of the meanings that these things have for them; that meaning is derived from social interaction; and that meanings are modified through an interpretive process used by people in dealing with the things they encounter (Blumer 1969).

Recent interactionist studies have tended to focus especially on professional, occupational and deviant groups (Strauss 1978b). The interactionist perspective has been particularly influential in the extension of the concept of career beyond occupations. This concept of career has proved valuable "in developing sequential models of various kinds of deviant behavior" (Becker 1963), and has also been extended to the notion of "moral career" to describe the experiences of mental patients in asylums (Goffman 1961). Research in this tradition has also re-examined what constitutes "work" and who is involved in carrying it out. Compare, for example, a study of office workers (Johnson and Rice 1987) with a study of the "hard, skilled work for the chronic patient" while hospitalized (Strauss and others 1981) or with a study of the "careers" of dance hall musicians (Becker 1963). Becker's book *Art Worlds* (1982) studies not the artists as personalities or their art works as inspired creations,

but instead focuses on the activities though which art is produced. This last work focuses on the networks of cooperation and assistance through which work is done, and draws heavily on the social worlds perspective, which I now discuss in greater detail.

2.2.2 Social Worlds

> After all, what is reality anyway? Nothin' but a collective hunch. My space chums think reality was once a primitive method of crowd control that got out of hand.
>
> — Trudy in Jane Wagner, *The Search for Signs of Intelligent Life in the Universe*

Social worlds are conceptualized as "... *activities* carried out in common with respect to a particular subject or area of concern" (Gerson 1983). The boundaries of a social worlds are set "neither by territory nor by formal membership" (Shibutani 1955), but rather these joint activities are bound together by a network of communication and are limited only by the effectiveness of this network (Kling and Gerson 1978, Shibutani 1955). In each social world, at least one primary activity is evident, and shared perspectives on that work arise through participation in common communication channels (Shibutani 1955). There are sites where activities occur, a technology (inherited or innovative modes of carrying out the social world's activities) is involved, and once under way, organizations evolve to further aspects of the world's activities (Strauss 1978b). Individuals are involved in one or more *lines of work*, activities and tasks people carry out in order to accomplish their work (Gerson 1983). The social worlds perspective provides a context for addressing problems of work organization and negotiated order, both of which have a long tradition in sociology (eg. Hughes 1971, Strauss 1978a).

Development of Conventions

> By convention there is color, by convention sweetness, by convention bitterness, but in reality there are atoms and space. (Democritus, Fragment 125)

Within a social world or subworld, members establish *conventions* in order to smoothly accomplish the work central to their world. Conventional practices are constructed through tacit agreement and their emergence helps define and locate a social world. Conventions are seldom rigid, but leave much to be resolved by interpretation and negotiation (Gilmore 1987). Becker (1982) compares the concept of a convention to other sociological concepts such as *norms*, *rules*, and *customs*. He uses this concept to understand the mechanisms of coordination among a diverse collection of individuals. His book, *Art Worlds*, describes the production and distribution of art as a collective activity. He uses the term, "art world," to denote the network of people whose cooperative activity, organized by their joint knowledge of conventional means of doing things, produces what we term "works of art." Gilmore (1987)

uses the notion of a convention to develop a model of coordination problem assessment in "concert worlds," and uses this model to analyze collaboration in these separate schools of activity.

Conventions (and even conventions about how to stray outside of the boundaries of conventions) are an important aspect of innovation. Gilmore (1988) defines three separate "concert worlds" or schools of activity and identifies two dimensions, innovativeness and virtuosity, along which they can be distinguished. He analyzes how individuals locate themselves within these worlds and how members of each subworld "speak the same language" with each other, often incomprehensible to others outside that world. Similarly, Zolberg (1980) examines differences in patterns of innovation in orchestras and art museums, identifying various features of different artistic media, and revealing the connections among specific art forms, organizational structures, and aesthetic outcomes. Her earlier work describes the shift in control over art museums from wealthy patrons to professional administrators and its impact on innovativeness (Zolberg 1974).

Processes of Transformation

Social worlds are not static entities, but change in response to developments both from within and without the social world. Subworlds consisting of individuals following related lines of work are formed when specialized subsets of these collective activities emerge, or new social worlds may emerge. Three important processes for understanding the development and change of various lines of work within a social world are: *segmentation* processes, *intersection* processes, and *legitimization* processes (Gerson 1983).

Segmentation processes embody the tendency for worlds to develop specialized concerns and interest within a larger community of common activities. An early forerunner in charting out mechanisms of segmentation and differentiation was Bucher and Strauss' (1961) paper on the process approach to professions. In contrast to functionalist approaches, which consider professions as relatively homogeneous communities, their approach considers professions to be loose amalgamations of segments with often opposing values and identities, delicately help together under a common name (Strauss 1984). Social worlds, of course, may span professions and yet the basic processes remain the same; within a social world, segmentation processes act to differentiate some members of the world from others as they form a new identity. In scientific work, for instance, social worlds may subdivide according to the technology used, the theoretical framework applied in data analysis, specialized classes of phenomena, and so on. They may be the results of an only partially successful "revolution" in the Kuhnian sense (Kuhn 1970).

Interaction processes govern the ways in which subworlds or lines of work interact with one another. Intersections occur when two or more lines of work come to share a single activity or cluster of related activities. An intersection can also be described as a system of

negotiating contexts in which resources such as money, skill, information, and prestige flow between work settings within distinct social worlds (Strauss 1978b, Gerson 1983). Intersection within scientific or academic worlds may be expressed by the emergence of new professional associations, journals, conferences, and so forth. In time, intersections may grow into stable subworlds in their own right (Gerson 1983). Fujimura (1986, 1988) uses the concepts of social world formation via intersection to document the emergence of the world of molecular biology in cancer research. In this case study, the intersection of several worlds was facilitated by the construction of a standardized "package" of oncogene theory and recombinant DNA technologies. In this case, the emergence of a new social world was inseparable from both the local and broad scale organization of work and infrastructure (Fujimura 1988).

Problems of *legitimation* arise at boundaries where segmentation and intersection processes occur. Each new line of work must establish itself as a legitimate enterprise within the larger social world. Thus, problems of legitimacy often involve the central questions of what it means to belong to a particular social world and to do work within that social world (Strauss 1982). The flow of both positive and negative sentiments play crucial roles, though they will be backed up by rationales acceptable within the established social world (Gerson (1983) terms this the language of "more scientific than thou"). Legitimation processes tend to reinforce segmentation and intersection processes. New lines of work that appear unsuccessful or ineffective will be cut off, while those that succeed will be supported by these processes.

2.2.3 Social Worlds and New Technology

The social worlds perspective can serve as a guide in understanding the fit between computer-based information and communication technologies and research activities in humanistic disciplines. The design and development of a technical artifact will be influenced by the conventions that exist in that social world. One way of discussing the "fit" between a technology and the social world into which it is being introduced is by considering which activities and lines of work that technology will support, and by analyzing with which conventions within a particular social system the technological artifact is compatible. An exact match is not necessary, of course, as lines of work may change and as new conventions may arise to support the technological artifact while other conventions will cease to be considered important. The construction and use of technological artifacts can initiate processes of segmentation, intersection, and legitimization as their designers and users begin to develop concerns and approaches that do not match those central to the larger social world.

Kling and Gerson (1978) use the social worlds perspective in an analysis of the computing world and describe the processes of intersection and segmentation taking place within that world. They identify patterns of segmentation in the computer world along four the major lines of cleavage. These new subworlds form along the *kinds of problems* solved by members,

the *kinds of technology* used, the *variety of application*, and the *relationship to IBM*, a major computer manufacturer. In future sections of the dissertation, I compare the patterns of segmentation within the computer world to that of the computing-in-the-Humanities world.

2.2.4 Social Worlds Compared to Other Frameworks

Earlier I described three other approaches to investigating and describing the organization of academic disciplines. Each of them focuses on some particular aspect of these disciplines, and exhibits some weaknesses. The social worlds perspective encompasses the strengths of these other approaches while overcoming some of their weaknesses. I will discuss the features of this perspective in more detail below, and will then assess its merits with respect to the other three organizing perspectives.

The social worlds perspective supports the analyst in developing an understanding of both formal and informal organizational structures that play a role for members of a social world. The emphasis on shared activities and patterns of interaction enable the analyst to detect and explicate either the brief, "loosely-coupled" ties mentioned above, or more stable networks of interaction that would interest those investigating "invisible colleges." Thus, this perspective provides all of the important features of other approaches to framing academic work and academic disciplines described above.

At the same time, the social worlds perspective preserves the other kinds of interactions mentioned above that the other three organizing perspectives do not support. Conventions capture permanence and continuity within social world interactions. Patterns of transformation embrace the emergence of new disciplines and subdisciplines, while the notion of membership in multiple social worlds and subworlds allows individuals to be defined in terms of multiple, often interdisciplinary, interests. Social worlds analysis looks beyond the products of interactions to the processes by which they are constructed; it includes individuals integral to these processes whose contributions would not be recognized by other analytical approaches.

Finally, an essential tension in any kind of collective activity is the tension between *individual* and *group*. There is a subtle difference between the first three approaches and the social worlds perspective that can be defined in terms of this tension. The first three perspectives are *individual-centered*; they define the relationship to the group of an individual, whether that "group" is an department, research community, or an *ad hoc* collection of individuals. The social worlds perspective, on the other hand, is *group-centered*, with individual members playing a role only insofar as their activities and interactions are a reflection of some element of the social world's definition and organization. Thus, this perspective is much more suited to an analysis of *collective* activity than the other three.

2.3 Methodology

> In that dark night which shrouds from our eyes the most remote antiquity, a light appears which cannot lead us astray; I speak of this incontestable truth: the social world is certainly the work of man.
>
> — Giambattista Vico, *The New Science*, 1744

I have conducted an empirical investigation of the impact of information technologies on classical scholarship. In order to employ the social worlds perspective to my study, I took as my premise that research in classics is accomplished by means of collective forms of social action. I considered classicists and others to be participants in the social world of classical scholarship, and scholarship the work that some people do.[1] My goal was to understand the phenomenon of change due to increased use of information technologies from the point of view of the members of this social world. In order to do this, I followed the procedures for *grounded theory* data collection and analysis as developed by Strauss and his associates (Glaser and Strauss 1967, Strauss 1987). I collected data through unstructured interviews with informants who are classical scholars in major departments, developers of research tools to support classical scholarship, and others. These data were supplemented by participant observation, when possible, and from secondary sources, such as journals, newsletters, and conference proceedings. They were also supplemented by data collected via *electronic* means, which I discuss in more detail below. Data collection and analysis occurred concurrently.

Both data collection and analysis are based on the assumption that social phenomena are complex phenomena, and that the unraveling of this complexity can be carried out by successive evolving, conceptually dense, interpretation. The mechanism for interpretation consists of a series of analytical memos constructed on the basis of the data, from which the analysis derives the constructs important within the social world, which, in turn, guide further data collection. This series of analytical memos make it possible to trace back abstract elements of the model to concrete elements of the data. Thus, a model of the social world of classics is developed "from the ground up," presenting a model based on the views and values of the participants themselves.

A key element of the grounded theory approach is the application of the constant comparative method. Using this method, the analyst seeks variation within conceptual categories on the basis of how the informants themselves perceive that variation. This differs from comparative studies that focus on "traditional" sociological constructs such as socio-economic status. For example, a more traditional approach might translate these constructs into tenure status and departmental resources, and ask how variation within these constructs influences classical scholarship and/or the use of computing technologies. They may play no role at all as they may not have any intrinsic meaning to the members of the social world themselves. However, categories relevant to that social world— such as the relationship between scholar

[1] See, for instance, the comment Becker (1982; p. xi) makes about his approach to studying art worlds.

and text— may play an important role in determining work activities and influencing the way particular technologies can and will be used.

2.3.1 Sources for Data Collection

> My conclusions have cost me some labor from the want of coincidence between accounts of the same occurrences by different eyewitnesses, arising sometimes from imperfect memory, sometimes from undue partiality for one side or the other.
>
> — Thucydides, *The History of the Peloponnesian War*, I:22.

The problem Thucydides had in the 5th century B.C. in painting as accurate a picture as possible of the Peloponnesian war is still a concern in historical and sociological research. Different informants often present one with different information, even about the same event or phenomenon. The activities of people are not always easy to recognize or understand. As Montaigne wrote in 1580,

> Truly man is a marvelously vain, diverse and undulating object. It is hard to found any constant and uniform judgment on him. (Essays, Book I)

In my work, I relied on a variety of sources to form a "constant and uniform" judgment of the members of the social world of classics. Unstructured and semi-structured interviews provided me with my primary source of data. Secondary sources included electronic mail and other on-line sources such as mailing lists and journals, as well as traditional (paper) newsletters, conference proceedings, journals and books.

Informants were drawn from several groups. They included individuals engaged in traditional scholarship, those engaged in the development of tools to support that scholarship, and those providing support services. Some individuals belonged to more than one group. The first group included both faculty members and graduate students which enabled me to get a better picture not only of what is is that "classical scholars" actually do, but also of how one learns to be a classical scholar. Another group's members are engaged in the development of tools for use in classical scholarship. Although I was also interested in the development of non-computer based tools (and interviews included individuals who were currently developing or had previously developed traditional tools), the focus here was on those applying new computer-based technologies to supporting classical scholarship. Finally, I drew on information from informants who are not classicists themselves, but who are necessary participants in the processes for the production and distribution of research products and research tools. These people include librarians, publishers, and support personnel.[2]

[2]These included 46 interviews with classicists or others using classical texts; 14 directors or staff members on tool building projects; and 8 "support personnel" for a total of 68. These numbers include some phone and electronic interviews, but not people whose correspondence was not directly with me (ie. contributors

Preliminary interviews uncovered a small core of "key" departments and projects within the US. Members of these departments set the tone for what is considered good work and what is considered a good department. I did not limit myself to just these "top" departments at research-oriented universities, however, but also included individuals from primarily teaching colleges (both private and public) and Christian universities, where classics forms a fundamental component of more general theological studies.[3] I also tried to balance computer users with non-users. Non-users include both those who dislike (or even fear) the computer and those for whom current adoption of certain computer-based research tools would not be expedient (for instance, those using texts not yet available in electronic form).

In-person interviews were generally conducted in a university office, though in some cases individuals were interviewed at their homes. (For many individuals, the home is their primary place of work and it is here that their computing equipment is located.) Interviews conducted with members of tool-building projects were, with one exception, conducted in the offices/labs of the projects themselves.[4] Some data from individual informants were collected electronically. These data were either drawn from public forums such as the bitnet mailing list *Humanist* for those interested in humanities computing, or through on-line correspondence with members of the classics scholarly and tool-building communities. In the former instance, individuals were engaged in public correspondence with all the members of a particular mailing list.[5] Three ways of getting in touch with individuals were (1) advertising my study and asking for willing respondents via Humanist, (2) sending mail to individuals included in

to the Humanist mailing list), nor does it include informal conversation with individuals at conferences. The average interview lasted between an hour and a half and two hours. The shortest interview lasted about 30 minutes (with an administrative assistant); the longest just over three hours (with a classicist). In some cases, additional phone follow-ups were conducted later. Three interviews were conducted exclusively via telephone, and each lasted over an hour (a Canadian classicist, a tool-developer in Texas, and the editor of an electronic mailing list). I also conducted 13 "electronic interviews," in which I sent an explanation of my study and a set of questions and issues of concern to individual classicists and received on-line responses. In two cases, this led to follow-up phone calls. Electronic responses were usually collected over the course of several mail exchanges (average three). While the average electronic response was shorter than the average in-person or telephone interview (approximately equivalent to 30 minutes, judging by number of pages of mail vs. number of pages of interview transcript), some responses were extremely complete, detailed, and frank (approximately equivalent to an hour or more of interview time).

[3]The decision to limit my study to the US was made primarily for pragmatic reasons. However, I wouldn't expect dramatically different results in any "western" culture where ties to the classics and ancient Greece and Rome are an integral part of the collective history especially since the U.S. classics community has fairly close ties with Western Europe. My correspondence (both via e-mail and paper mail) has included individuals from Canada, England, The Netherlands, and Israel. A number of important journals are European, and one of the major publishers of classical texts is Brill in The Netherlands. Many departments are also hiring British professors who are leaving due to restricted opportunities in the UK, while versions of tools such as the TLG have been exported to most Western European countries. I have not investigated the role of classics in non-western countries.

[4]In one case, the two people interviewed were no longer directly associated with the project, but one was still working in a part-time and advisory capacity. These people were interviewed at home.

[5]Mailing lists such as *Humanist* are informal forums, as opposed to more formal correspondence via the "letters" section of a journal or newsletter. More details follow in a subsequent chapter.

the *American Philological Association's* bitnet address list,[6] and (3) getting addresses from informants who said that they regularly corresponded with certain individuals.

Secondary sources tended to fall into one of three categories: those dealing with issues of traditional scholarship; those geared towards *developers* of computer-based tools to support scholarship; and those directed at *users of these tools.* Examples of the first kind of source include journals such as the *Harvard Studies in Classical Philology*, critical editions or commentaries of texts, and research aids such as the Turney and Italie (1954) concordance to Euripides. Developers of computer-based tools have their own set of journals, conferences, and professional societies, such as the *Associations for Computing in the Humanities*, which publishes its own journal and holds a yearly conference jointly with the Association for Literary and Linguistic Computing. And, finally, various newsletters, mailing lists, and users groups exist to support those interested in employing new technologies in conducting traditional scholarly investigations. A recent issue of *Reach*[7] (January/February 1991), for instance, contained information about subscribing to electronic discussion groups and using anonymous FTP (File Transfer Protocol), a UNIX process used to transfer files from one computer system to another.

In-depth, in-person interviews with scholars and developers formed the cornerstone of my investigation. However, the variety of other sources available to me, whether formal or informal, whether distributed electronically or in paper format, served both to suggest further lines of inquiry and to corroborate information gathered from individuals in the field. In many instances, what appeared to be a "want of coincidence" lead to a deeper understanding of the various dimensions of a task, an kind of interaction, or a theoretical category.

2.4 Summary

In this chapter, I reviewed a set of approaches used to describe various aspects of academic activites and disciplinary structures, including bureaucratic models, loosely-coupled systems, the "field-coverage" principle and "fish-scale" model, and invisible colleges. I outlined the analytical framework upon which I drew, the social worlds perspective, and concluded by describing my methods of data collection and analysis, and my various sources of data.

---

[6] I had about 60 bitnet addresses to which I received five replies. Not a very good response rate, but it is also hard to tell how many of the individuals listed actually *read* their mail.

[7] *Research & Educational Applications of Computers in the Humanities*, a newsletter published by the Humanities Computing Facility of the University of California at Santa Barbara.

Chapter 3

Classical Scholarship Described

O ye, who patiently explore
The wreck of Herculanean lore,
What rapture! could ye seize
Some Theban fragment, or unroll
One precious, tender-hearted, scroll
Of pure Simonides.
— William Wordsworth, *Departing summer ...*

In this chapter, I describe the discipline of classical scholarship, using elements of the social worlds perspective. Drawing on both readings and interview data, I try to establish a picture of how classicists view themselves and their work. I focus on the questions they address and the problems that they face in answering them. I also try to give the reader a sense of how classicists define the value of studying ancient literature and culture in a modern context, and how they perceive themselves and their discipline with respect to the sciences and technological artifacts. Finally, I present the reader with a brief overview of computing in the humanities and in classics, describing in particular two tool-development projects that play an important role in the computerization of classics. This will lead into the next chapter, which will discuss both pre- and post-computer tools, techniques and approaches that classicists use to carry out their work.

3.1 What is Classics?

It's as large as life and twice as natural.

— Lewis Carroll, *Through the Looking-Glass*

I've now outlined various means of describing and talking about the organization of academic disciplines. In my work, I use the *social worlds perspective* as an organizing mechanism for defining and describing various aspects of classical scholarship. In trying to describe classics

to a presumably non-classicist reader. I encountered a number of problems of circularity. In hopes of having found a way to minimize confusion, this section is arranged as follows. First, I briefly define the broad goals of classical scholarship. Secondly, I describe classics as a social world. Thirdly, I discuss in more depth one aspect of classics, *literary analysis*, as a primary activity within the social world. This sub-section is the most detailed, as it covers the nature of the data that classicists draw upon, various aspects of literary analysis (particularly textual criticism), and includes an extremely abridged history of classical scholarship. Finally, I discuss the values of classicists, especially their often very personal relationships to the texts that are their subjects of study, and their views on the nature and methods of scholarship.

3.1.1 Classics Defined

Classics is a Humanistic discipline and, as such, shares many elements of ideology, tools, and techniques with other disciplines in the Humanities. The goals and boundaries of classical scholarship as an enterprise can perhaps be best illustrated with a quote from von Wilamowitz-Moellendorff, a 19th century German classicist:

> The nature of classical scholarship ... is defined by its subject-matter: Graeco-Roman civilization in its essence and in every facet of its existence. ... [T]he task of scholarship is to bring that dead world to life by the power of science— to recreate the poet's song, the thought of the philosopher, ... mankind at work and play. ... Because the life we strive to fathom is a single whole, our science too is a single whole. Its division into the separate disciplines of language and literature, archaeology, ancient history, epigraphy, numismatics and, latterly, papyrology, can be justified only as a concession to the limitations of human capacity and must not be allowed to stifle awareness of the whole, even in the specialist. (von Wilamowitz-Moellendorff 1982)

Some would most aptly describe classics as a set of interdisciplinary studies (Hellenist), and in many ways this is true, especially given current institutional arrangements of faculty and specialties into departments. However, the one key phrase here is *awareness of the whole*, a recurrent theme whether classicists talk about their relationship to a text, to the corpus of Greek or Latin literature, or to other areas or fields of scholarship.

3.1.2 Classics as a Social World

Taken broadly, the social world of *Classics* could includes a wide variety of people, from university professors to amateur archaeologists touring the Acropolis, from museum curators

to schoolchildren reading Greek and Roman mythology. All these people are, certainly, striving to "bring that dead world to life." Within this larger social world, I am looking at a those people engaged in the bringing the world to life "by the power of science": individuals generally located at universities and involved in systematic efforts to discover and explain facets of ancient Greek and Roman culture. This is the world of *classical scholarship.* This subworld of the larger "Classics World" constitutes a social world in its own right, and when I talk about classics, it is to this social world that I refer.

Research done at academic institutions forms the core set of activities of this social world. However, the members included in this social world extend beyond the confines of a formal Department of Classics. Just as the social world of art includes art dealers, audience members, and museum curators (Becker 1982), so are publishers, librarians, secretaries and others vital to the production, distribution, and evaluation of classical scholarship.

Taking my cue from Becker (1982), I treat classical scholarship as *the work some people do* and shall concern myself with *how this work gets done* rather than with the intellectual merits of that work or the academic brilliance of its creators. In particular, I focus on the activity of *literary scholarship* (loosely defined for now as the refinement and analysis of textual materials, and more carefully defined below). I focus on the activities in which classicists engage in order to carry out this research, from first idea to published work. I try to uncover the manner in which they and other members of this social world coordinate these activities. Most importantly, I try to assess the ways in which the introduction of new computer-based research tools intervenes in and alters these activities.

We can test out classics in terms of the features Strauss (1978) assigns to social worlds. These is at least one primary activity evident: literary scholarship. Around this activity, a number of lines of work have formed. Nevertheless, working with *the text* and grounding ones work in *the text* is a vital component of all scholarly activities. There are sites where these activities occur: in this case, they occur predominantly in departments of classical studies, usually located within a school of Humanities and within a college or university. A technology is involved: in this case, the technology includes both computer-based research tools less than 10 years old, and techniques for literary criticism that go back for literally millenia. Finally, organizations evolve to further aspects of the world's activities: these include libraries, professional societies, and private foundations for supporting research. Classicists are also bound together by a network of communication. Some important elements of this network are interactions either in person, by mail, or by phone; annual meetings; journals and newsletters; the *L'Annee Philologique* (a bibliography of all scholarship published in a given year); and informal communications between members of a department. Later sections of the dissertation will expand upon the various features and communication networks important to the social world of classics.

Conventions in the Production of Classical Scholarship

The establishment of conventions within a social world helps minimize the amount of decision-making necessary in carrying out work. Classical scholars don't constantly re-decide on how to refer to a certain verse or line of Homer,[1] or how to mark a missing letter when preparing a printed edition of papyri. Instead, they rely on a number of conventions to select, locate, organize, and distribute information, particularly information about the text.

Many conventions center around the presentation of and access to textual materials, and some of these conventions were or are based on those established in earlier periods of scholarship. Consider the classification of literature into genres. Already with Horace (65-8 B.C.) we find a discussion of the *lex operis*, the "law of the work," though historically "genre-theory" is much more a inheritance from the Renaissance than from antiquity. Nevertheless, conventions for classification do, indeed, date back to ancient times, with Plato first proposing theoretical distinctions between different kinds of poetry, and Cicero writing on the relationship between oratory and other kinds of literature (Russell 1981:Chapter 10).[2]

Similarly, conventions for indexing works or portions of works, referred to as *citation systems*, are often the product of long-standing agreements, often established in the Middle Ages or Renaissance. Consistent citation systems are particularly important as critical arguments may hinge on a particular word or phrase. Not all cases are covered, and one of the editors of the *Thesaurus Linguae Graecae Canon of Greek Authors and Works* (Berkowitz and Squitier 1986) speaks about the occasional need to expand the coverage.

> Appendix 4 is an index of citation systems. For instance, volume, fragment, line. For the most part, these are traditional. If we don't get anything, we have to impose a system. For instance, we might get an edition with no line numbers, or sections that are not completely identified. We try to recognize what they use; we try to recognize what people in the field use. (Project Staff Member and Latinist)

When fragmentary or questionable textual materials are published, the editor needs a way of marking missing letters, potential errors of transcription, damaged portions of the manuscript, or sections deemed spurious. Again, papyrologists and others have established editorial conventions for marking such occurrences (Youtie 1974). And again, the use of critical signs has its basis in antiquity (Reynolds and Wilson 1974).

---

[1] A Greek epic poet regarded in antiquity as the author of the *Iliad* and *Odyssey*, dated by critics as having been born as early as the 12th century B.C. by Eratosthenes (head of the Alexandrian Library around 234 B.C. and the first to draw a rough system of latitudes and longitudes on the map of the world), and as late as the 7th century by some modern critics. Recent authorities tend to place him in the 9th century.

[2] Of course, the ability to make these distinctions relies on the fact that Greek and Roman authors themselves tended to adhere to a fairly rigid set of conventions of content meter, and music (Russell 1981).

Research aids are formed around another set of conventions which will be discussed later in the dissertation.

3.1.3 History and Background of the Discipline

Classical scholarship dates back literally for millenia. Needless to say, a comprehensive history of classical scholarship would be beyond the scope of this dissertation, and is more than adequately described elsewhere.[3] Instead, I'll briefly cover a few interesting *features* of the history and highlight a few important events. Classical scholarship as a tradition has ancient roots, though what was meant by that term then might be quite different from what we mean by it now. Although Aristotle[4] is often named as the founder of literary criticism, the "river of Aristotelian criticism was fed by a number of streams," whose underground springs run from Homer (9th century B.C.?) to the advent of the sophists (about the 5th century B.C.) (Harriott 1969). Pfeiffer (1968), too, traces the origins of classical scholarship back to the era of Homer and Hesiod.[5] The study of literature in antiquity was very rudimentary by modern standards. The authorship of books was often unsure, styles and techniques highly conventionalized and lacking in individuality, and literary property was not very closely guarded.

Scholarship as a science probably first emerged in the third century B.C when the great Library was established as part of the *Museum*, or temple of the Muses, in Alexandria. This was one of the first true centers of scholarship allowing a variety of individuals to meet and work together on problems of literary analysis. Questions of textual standardization and interpretation were debated by a group of scholars brought there expressly for that purpose or, in the words of Timon of Phlius, "in populous Egypt they fatten up many bookish pedants who quarrel unceasingly in the Muses' bird-cage."[6] It was here that many original advances in scholarly methods were made, some of which are still applied today or which served as the basis for modern methods. For instance, Reynolds and Wilson (1974) write that "the need to establish the text of Homer ... inspired scholars to define and apply the principles of literary scholarship more systematically than had been attempted before. Discussion of difficult passages led not merely to the production of a reliable text ... but to commentaries." Alexandria continued as the center of critical activities until the beginning of the first century B.C., when this center shifted over to Rome (Atkins 1952).

The fate of classical scholarship and the transmission of classical texts has been influenced by social and intellectual movements not confined to the discipline itself. The growth of the

[3]Interested parties should consult works by Pfeiffer (1968, 1976), von Wilamowitz-Moellendorff (1982), and Reynolds and Wilson (1974) for a more in-depth discussion and further pointers into the literature.

[4]A Greek philosopher who lived from 384–322 B.C.

[5]Hesiod was an early Greek poet, writing perhaps in the 8th century B.C.

[6]From the Athenaeus I.22d, quoted in Reynolds and Wilson (1974).

Christian Church, for instance, had profound and important effects on the transmission of classical literature (the histories of Eastern and Western Europe are quite different, but they do share certain key aspects, and I treat them jointly here). While the literary merit of the classical authors tempted some Christians to preserve and read them, and while allegorical interpretations might be used to make certain passages inoffensive to Christian taste, there is no doubt that Christians were discouraged from reading them. While there are few, if any, documented cases of deliberate book burnings (usually reserved for Christian authors turned heretic), the general lack of interest resulted in a complementary lack of new or replacement copies, deadly in an age of war and destruction. (Reynolds and Wilson 1974; pp. 42–44, p. 76). This was true both in Eastern and Western Europe, though the Christians in the West were more overtly hostile to pagan literature. Wilson and Reynolds (1974) write, "Decimated by the continued destruction of war, faced by hostility or neglect at the hands of the new intellectuals, the Latin classics seemed to have a slim chance of survival." Books often found a refuge in monasteries; even here, however, they were in danger of perishing to make way for the new: "The fate which often overtook the handsome books of antiquity is dismally illustrated by the surviving palimpsests— manuscripts in which the original texts have been washed off to make way for works which at the time were in greater demand" (Reynolds and Wilson 1974). The Renaissance saw once again a flowering of interest in classical literature, but not before many important texts had been lost forever.

Classical scholarship and classical literature has also contributed to the establishment and legitimation of values and movements not confined to the discipline itself. Anyone who has even the briefest acquaintance with western European literature cannot fail to notice the influence of Greek and Roman authors. Outside of literature, however, one of the most profound examples of classics' sphere of influence is the rise of Romantic Hellenism or Neohellenism around Napoleon's time, and carried over into Nazism. This "approach" or philosophical orientation found its inspiration not in Roman literature, but in the "noble simplicity and serene greatness" of the Greeks such as Homer, Sophocles, Herodotus, and Plato, and called for the imitation of the ancients. This approach, first inspired by Greek poetry, was then applied to art and literature. In Germany, there grew up even an evangelistic humanism, a powerful movement headed by Johann Joachim Winkelmann, which took its place beside the systems of Kant, Hegel, and others (Pfeiffer 1976). Neohellenism also lead to the establishment of "Aryan" models of the development of civilization around the first half of the nineteenth century led to the denial of Egyptian and Phoenician influences on Greek culture. This borrowing, openly acknowledged in the Renaissance and mentioned directly by Herodotus in his *History*, is now being recognized openly again, though often only by those on the fringes of classics (Bernal 1987).[7] These models were long used to justify claims of Aryan racial superiority.

[7]Herodotus (c. 480–c. 425 B.C.), a Greek historian, was considered by Cicero and others "the father of history." He was the first to make events of the past the subject of research and verification (Harvey 1986).

One periodically important component of classics has been the imitation or revival of ancient arts. The motive for study of classical texts has often been *imitation:* to learn from the ancients through their work. One of the great educators and scholars of the late eighteenth and early nineteenth century, Friedrich August Wolf,[8] firmly held to the ideal of a culture founded on Greek traditions and worked actively to raise the level of classical studies within the university (Sandys 1958). He considered instruction in the classics a "purely human education" leading to "a beautiful harmony of the inner and outer man" (from Pattison 1889, quoted in Sandys 1958). Most importantly, Wolf and others saw it this form of education as a prime force in the development of a national culture.[9] This notion of an "ideal culture" based on ancient Greek tradition and lore has served both as goal and as justification, particularly in the field of education (consider the British emphasis on a "classical education" of which Greek and Latin were a vital component). In tracing the history of classical scholarship, it is important to remember that the *goals* of scholarship are not always constant, the individuals who engaged in it changed, and its relationship to other social worlds was subject to dramatic shifts in response to other social, political, religious or economic events.

Certain another important— indeed, a vital— part of the history of classics is the advent of the printing press in the late fifteenth century. This topic will be covered in a subsequent chapter in the context of social change effected by new media.

3.1.4 The Data

> ...the fallibility of printed books is exemplified by the edition of the Bible, *circa* 1702, in which David, usually persecuted by princes, laments in Psalm 119, verse 161 that 'Printers have persecuted me without cause ...'. (Boulton 1980)

But what exactly is the data that classicists use? Data is "information, esp. information organized for analysis or used as the basis for a decision" (American Heritage Dictionary). In the case of classics, data (or information) is drawn from many sources. Sources include artifacts such as household objects, works of art, temples, fragments of ships, grinding stones, and so forth. Most sources used by classicists, however, are *textual* sources such as histories, plays, tax records, letters, military lists, inscriptions, even graffiti and receipts scratched onto

[8] F. A. Wolf (1759–1824) spent 17 of his most influential years teaching at Halle in Germany. Among other contributions, his views on the divided authorship of the songs composing the Homeric poems re-opened this topic among scholars of the next generation (Sandys 1958).

[9] In *Darstellung der Alterthums-Wissenschaft*, first published in 1807, Wolf writes, "Alle bisherigen Ansichten laufen zu diesem vornehmsten Ziele wie zu einem Mittelpunkt zusammen. Es ist aber dieses Ziel kein anderes als die Kenntniss der alterthümlichen Menschheit selbst, welche Kenntniss aus der durch das Studium der alten Ueberreste bedingten Beobachtung einer organisch entwickelten bedeutungsvollen National-Bildung hervorgeht" (see Wolf 1985).

shards of pottery. There is another set of data, and that is the kind "organized for analysis," which includes tools such as a lemmatized concordance, maps, or computerized data banks. These data— different kinds of information— provide the fodder for the information processing mill.

What are the problems with some of these data sources? In using textual sources, the classical scholar comes face to face with several problems that are physical, social, or organizational in nature. Some problems relate to the physical state of the data. Papyrus disintegrates over time, inscriptions wear away, manuscripts may no longer be in good shape. Scribes, both in ancient Greece and Rome as well as in the middle ages, might be sloppy, careless, or merely tired when writing or transcribing documents, leaving behind a text that is difficult to read or incorrect through errors of omission or word substitution (Youtie 1974, West 1973). Social and political factors can also affect dissemination; texts were often copied quite selectively. What was not deemed important, interesting, or "politically correct" during a given era was frequently lost. Thus, the remaining texts are anything but a representative sample, and some texts are only known through references to them in other works (Finley 1981). Lastly, there is the question of attribution. The wrong name may get to attached to a work for reasons both accidental and deliberate. Thus, time, carelessness, and selectivity make difficult the job of reconstructing a text, a language and, ultimately, a civilization.

This is where the importance of the *edition* emerges. As scholarship advances, older editions become quite literally out-dated: an old book or set of books may contain items now dropped from the cannon or may lack items subsequently found and possibly important (Boulton 1980).

Boundary Objects and Conventions

How do classicists manage to carry out their work under such conditions? The answer is as follows: although their day-to-day workings with the data may be frustrating and may reveal the myriad of problems and inadequacies facing the researcher, there exists an *ideal notion* of the continuity and unity surrounding both the materials and history of classical literature. This ideal notion, to which I will refer as a *boundary object*, makes it possible for a group of disparate people to successfully use a very complex and incomplete set of data.

Boundary objects evolve within a diverse community and become artifacts that are plastic enough to adapt to the needs of individual groups, yet robust enough to maintain a common identity across different groups, different sites, and even over long periods of time. How this process occurs is not yet well understood, but we recognize that such objects, whether concrete or abstract, can serve as bridges between different communities or social subworlds (Star 1987, Star and Griesemer 1989, Star and Bowker 1990). The concept arose from studies of collaborative efforts in scientific work, where contributors to a collaborative effort may come to a project with a highly diverse set of needs and perspectives. Boundary

objects and their manner of access often embody and reinforce a set of *conventions* within one or more disciplines, thus freeing its members from the need to constantly renegotiate the methods or materials to be used in their work (Becker 1982, Gilmore 1987).

I distinguish here between four types of boundary objects, paraphrased from Star and Griesemer (1989) and King and Star (1990). Boundary objects can be *repositories*, ordered collections of information indexed in a standardized fashion. Repositories deal with difficulties that arise when people partition problems using different units of analysis, and they have the advantage of modularity. Boundary objects can also serve as ideal *ideal types*, objects which do not accurately describe the details of any one locality or thing but are abstracted from several domains, and may be fairly vague. They arise with differences in degrees of abstraction and result in the deletion of local contingencies from the common object. They can form *coincident boundaries.* These are common objects which have the same boundaries but different internal contents, and they arise in the presence of different means of aggregating data, and when work is distributed over geographic areas. Finally, *standardized forms* can become boundary objects when devised as methods of common communication across dispersed workgroups. They are especially important when work takes place at distributed work sites.

Two important boundary objects for classicists are the *corpus* and the *textual edition.* The *corpus* serves as an important *ideal type* for classical scholars and allows a wide-ranging, widely-dispersed set of researchers to discuss a fragmented and complex body of work as a unified whole. The *textual edition* allows them to take an individual work from the corpus and "pick it apart." Both embody a set of conventions, and will be discussed in more detail below.

The *Corpus* and *Canon* as Boundary Objects

A *corpus* is "a large collection of writings of a specific kind or on a specific subject"; a *canon* is "an authoritative list, as of the works of an author".[10] Used somewhat interchangeably in colloquial speech, what role do corpus and canon play in classical scholarship? When classicists speak of the corpus of Greek or Latin works, they refer to a collection of writings that can really never be firmly established or completely compiled. Too many writings were lost over the centuries, and that which remains is often in such a corrupted state that no one will ever be able to say with authority, "This is what Sallust wrote." In some cases, such as for Homer, even the very notion of single authorship is in dispute, and some argue that what we think of as the writings of Homer are really the compiled writings of several ancient authors (Harvey 1986). Nevertheless, without the notion that there is an identifiable and accessible corpus, it would be impossible to make even partially definitive statements about the language, literature, or culture of ancient Greece or Rome.

[10] *American Heritage Dictionary*, 1985 edition.

One embodiment of this ideal corpus are published canon of authors or manuscripts, sometimes limited to a particular group or type of texts (such as latin papyri (Cavenaile 1958). These may consist of the texts themselves, or may simply act as "pointers" to these texts and their locations. Arguments may arise around the inclusion of particularly marginal works in this "corpus"; for instance, there is disagreement about the inclusion of 3rd, 4th and 5th century Patristic authors in a computerized databank of Greek literature, the *Thesaurus Linguae Graecae* (TLG) (Hellenist). These are relatively minor squabbles since, as with so many conventions in classics, the canon for Greece and Rome was tentatively already established in the middle ages (Roman Social Historian). One by-product of the TLG has been the publication in book form of a canon of Greek authors and works, referred to hereafter as the TLG Canon (Berkowitz and Squitier 1986). Again, this is only an approximation of the ideal. One classicist says,

> The TLG has compiled a canon of ancient greek authors. It's an authoritative listing of all existing authors. There have been other listings. They will never be complete; odds are you'll miss something; there is no complete manuscript collection. This is the first time that anyone is coming close. There are lots of obscure things, literature never even heard of before. (Classics Grad Student)

Within the TLG Canon, the works of each author are ordered, indexed, and labeled with a genre. The inclusion of particular works in a canon is often based on previous classification efforts. Consider the following comment:

> Die Vulgata der griechischen Bukoliker stammt von Henri Estienne [die zweite Ausgabe von 1579]; sein Gedünken hat, natürlich zum Teil nach dem Vorgange älterer ebenso willkürlicher Herausgeber, die Reihenfolge und die Zählung der Gedichte und auch die Dichternamen im wesentlichen festgestellt, die seitdem durch die Macht der Gewohnheit herrschen. (von Wilamowitz-Moellendorff 1906).

> The accepted edition of the Greek pastoral poets was compiled by Henri Estienne [the second edition of 1579]; his decisions and ideas have set the order and the numbering of the poems, and also pretty much determined the naming of the poets, naturally in part guided by previous and equally arbitrary editors, *which have prevailed since then through custom.* (my translation, emphasis added)

Ordering of texts is very important, and is established by tradition and convention.

> For the plays of Aeschylus, there is an order normally regarded as the way to do it. For Euripides they might be listed alphabetically, not chronologically. That's the tradition, the way we understand it. For Plutarch, the tradition says first the Lives, in order of identification in the Middle Ages, then the Moral Essays, and so on. (Project Staff Member and Latinist)

In this way, the canon, while influenced in its origins by individual judgment, is, finally, a social construction; indeed, the "literary canon," through usually fixed within a given time and place, varies considerably across space and time (Eagleton 1983). For example, some works were simply not transmitted because medieval scribes considered them unimportant or even dangerous; thus, they are not even available for inclusion in the canon due to *mores* and values that may no longer be current (Hellenist). The selection of works for a particular canon, such as the TLG, is sometimes based on criteria other than scholarly ones: "western" editions were considered preferable as they are more accessible to western readers. There are other opportunities for disagreement, too: a certain work may be considered spurious by some, authentic by others.

The TLG canon, as represented not only by the published book but on the corresponding collection of electronically-stored texts, is becoming an important boundary object within classics, as the definition of "on the CD ROM" or "on the IBYCUS" becomes synonymous with "the corpus of texts."[11] Similarly, conducting a complete search (thereby doing complete work) is becoming synonymous with doing a search "on the computer" or "using the TLG."

Within this *corpus* lies a "core" set of texts which remain exceptionally consistent across departments. Every department of classical studies, for instance, has a list of works and authors which graduate students are expected to read in order to prepare for their comprehensive examinations. While there is some variation across lists, virtually all of them include certain "standard" authors and works, such as Homer's *Iliad* or Cicero's orations.[12]

3.1.5 Questions and Problems for Classicists

The classicists interviewed are predominantly involved in *literary scholarship*, which is categorized by Thorpe (1964) as follows:

> *linguistics*, which deals with the structure and operation of language as a medium of expression and communication; *textual criticism*, which undertakes to establish texts in the form which the author intended; *literary history*, which treats the literary work in all of its relationships as an historical event; *literary criticism*, which tries to identify and interpret the literary work in the light of all other relevant literature. (emphasis added)

[11] "CD ROM" stands for "Compact Disc Read Only Memory." It refers to an optical disk (like the compact disks replacing records and tapes these days) on which information is, at this point, permanently stored and retrieved via lasers. The TLG projects offers its electronic texts via several media, including on a CD ROM. More on that later.

[12] The lists I looked at came from graduate study brochures from UC Irvine, UCSC, UC Berkeley, Yale University, and Stanford University.

These activities are often highly inter-related and inter-connected; the success of either one depends on the success of the other. They may occur hundreds or even thousands of years apart. In the course of carrying out these activities, classicists often develop tools to aid them in their work. The classicists interviewed for this particular study primarily fall into one of the latter three categories (textual criticism, literary history, and literary criticism).

Some Specific Examples

What kinds of problems and questions, then, do classicists actually address in their work? Other sections and future chapters will go into more detail about the specific types of research questions and the activities involved in addressing them, but I'll start with a few concrete examples.

> **Transmission of texts:** Studying the relationships between the seven different extant medieval manuscripts and early printed editions of Aeschelus' tragedy, "The Suppliant Women."
>
> **Literary analysis:** Understanding how Greek tragic poets used allusion to each others' works to evoke emotional responses in the reader.
>
> **Classical philosophy:** Reconstructing the epicurean arguments for the existence of gods, and for the possibility of them being immortal and living beings, by means of inferences from partial and fragmentary texts.
>
> **Social history:** Writing on the private life of the Roman family, and of the affective ties between parents and their children.

Note that these topics all share a need for good *textual* sources in order to enlarge our understanding of one aspect of ancient Greek or Roman civilization.

Textual Criticism

As mentioned above, textual data is often in a sad and sorry shape. In refining textual data, classicists may work with anything from seven-letter scraps of papyrus to medieval copies of late Roman manuscripts. This is a vital activity, and Boulton (1980) writes,

> Some of the most exact, exhausting and honourable scholarship is that which aims at establishing the text *probably nearest to the author's intention* (which may itself have changed over some years). The sciences involved— descriptive bibliography, textual criticism and (for manuscripts) palaeography— are highly specialized, detailed and difficult .... (emphasis added)

There are many strategies and procedures that can be applied in emendation, which are outlined in books such as Renham's reader in Greek textual criticism (Renehan 1969), Reynolds and Wilson's chapter on textual criticism (Reynolds and Wilson 1974), or taught by example in graduate-level courses in research methods. Good emendation requires starting from the thought, only afterwards taking into account considerations of meter or palaeography (Houseman 1961), and all readings must be founded upon "wide and careful reading combined with a constant effort to refine one's sense of the probable" (Renehan 1969).

Historical and Literary Analysis

Those engaged in interpretive activities, either concurrently or at different points in their academic careers, use not only the texts, but turn to other materials, including dictionaries, writings of the contemporaries of the author whose works they are studying, and secondary literature. Classicists use the text and supplementary materials to make statements about the social arrangements, customs, religious belief, and characteristics of these ancient societies. For instance, a hellenist might use the works of the historian Thucydides to explore the characterization of various national groups with respect to their behavior and strategy in war.

In the course of their work, individuals sometimes find that they need to develop some kind of tool for their own use. For instance, in the course of writing about a certain author, a classicist may find that she first has to compile her own concordance to the author's works. The full range of tools and techniques is discussed in the following chapter.

3.1.6 Values and Problems of the Discipline

> Classical Quotation is the *parole* of literary men all over the world.
>
> — James Boswell, *Life of Johnson* (1728)

Finally, I address the question of motivation and how this is driven by the value classicists hold with respect to their materials and their field. "Why do people study classics," I am asked frequently by people outside the disciplines in the Humanities. According to scholars and graduate students within the discipline, the value of classical scholarship lies in its applicability to general topics and themes of inquiry. A Latinist maintains that "[e]verything you teach, read, work on, deals with the texts that are some of the greatest documents in the world. The problems of humankind exist in front of you" (Hellenist). Consider the papyrologist who says, "[i]f you understand how other cultures construct themselves you understand how to place yourself in your own culture. ... Classics is a good vehicle for this" (Stephens). Even if one argues that classical Greek and Roman culture is quite different from

modern American culture, comparing our "human experience" with that of previous epochs allows us to better assess our own experience "with objective detachment and so widen our own horizons" (Kresik 1981). The influence of the Romans and Greeks is no myth: in an appraisal of the influence of Greek culture on later epochs of Western Europe and the Middle East, Bolgar examines how different generations borrowed, adapted, modified, and interpreted Greek culture. Indeed, for each generation "Greece wore a different face" (Bolgar 1981).

Of course, classicists could all become sociologists and compare the culture of the so-called "western" nations to other *living* cultures. The argument for studying ancient Greek and Roman cultures, however, is particularly salient in an American and European context, where Greek and Roman societies are considered "the cradle of Western civilization" (Classicist).[13] As Kresik writes, "The literature of classical antiquity is the mother of our Western literature. Without her heritage we would sever the Medieval and Modern literature of the Western world from its source and its point of reference .... The long receding corridor of almost three millenia would no longer be illuminated" (Kresik 1981). This argument loses value in countries with different cultural origins, such as Israel, where classics departments are more likely to be maintained because of a feeling that a "proper university" must have a classics department (Classicist).

Increased cultural understanding is not meant to be engaged in as an activity in a vacuum; classicists see direct and immediate application of an understanding of our past to making choices about our future. This conviction is evident in both what people say and what they write.

> In an age of mass destruction, we should have money put into things that are culturally valuable, not just in a utilitarian way. One thousandth of one percent of Star Wars could fund all the humanities and classics. The benefits would be greater. ...[Graeco-Roman philosophy] is the origin of the cultural values of western tradition. (Latinist)

> We preserve the past because we want to know who we are, where we come from. Culture, continuity— this is like knowing your family's past. It's a human need. (Project Staff Member and Classicist)

> ...[T]hough classical studies are by no means the only ones that provide a useful intellectual training, their ability to do so contributes greatly to their value. ...[L]earning exists for people, and not people for the sake of learning; we study antiquity in order to use it for our own purposes. (Lloyd-Jones 1982, p. 11, Regius Professor of Greek at Oxford)

[13]This phrase also appears in a brochure explaining about the *Thesaurus Linguae Graecae*, available from the TLG project, University of California, Irvine, 92717.

Classicists see scholarship as an art, not a science, which can never be mechanized. Furthermore, they view classical literacy as culturally valuable— indeed, essential to intellectual development (Reedy 1988).

The Relationship Between Scholar and Text

Office system visionaries such as Giuliano (1985) propose a "paperless" office; will scholars ever find themselves in a similar environment? They seem to think not.

> So, I bet classicists 50 years from now will still like books. It's not just that people use the books, it's that we like books. The feel is still right, ... you feel the page as opposed to using the cursor. There's a certain aesthetic involved that's going to help the book survive for quite a while yet. (Classicist)

One particularly important shared *value* is the role of the text and the relationship of the scholar to the text. In order to truly understand a text, one must have personally read it. For example, a graduate student in English working on a concordance project for *Piers Plowman*[14] spent part of this summer entering the text into the computer. Her advisor told her that she was lucky in that she was being exposed to the text literally on a keystroke by keystroke basis. This, he said, is a level at which most students of the text never work with it (Medievalist). The value of personal and in-depth acquaintance with a text or an author is echoed by a number of classicists.

> I started where a scholar has to start— with the texts, the manuscripts, the textual tradition. (Hellenist)

> Having read five percent of the extant literature is different from having read twentyfive percent or fifty, or seventyfive percent. You read vast amounts of texts. ... It gives you a real sense of what X was like to have read it yourself. (Papyrologist)

New forms of presenting and accessing textual data have the potential to upset this traditional relationship. The ambivalence scholars express towards the use of computers in their work is often a reaction to this. While they recognize the salient advantages of using the computer given the institutional context within which most classicists work (such as needing to produce some loosely-specified number of papers in order to get tenure), these same

[14] *Piers Plowman* is an alliterative poem written in Middle English and attributed to William Langland. Three versions, aptly entitled the "A" text, the "B" text, and the "C" text, exist. Note that none of these versions is in the author's own handwriting. The three versions are combinations of authorial revisions and scribal changes. Just as an aside, Ruffolo (forthcoming) contains a superb analysis of the role of lists as an expression of the author's recognition of the singularity or multiplicity of authority in *Piers Plowman* and other medieval alliterative poetry. Some of her discussion of singularity vs. multiplicity of authorship may have some bearing on issues of computer-supported collaborative work.

advantages often conflict with the values of the discipline itself. Consider these comments on the impact of the computer on their work.

> The basis [of scholarship] is reading texts. ... There is a risk that computers will supplant that. When you read, you learn things that you aren't even searching for. The human brain may be searching for X, but will be confronted with other things. (Latinist)
>
> I find it quite salutary, as a matter of fact, not to have a computer [because] I sit down and read the stuff. (Latin Historian)
>
> [Using the computer for searching] detaches you from the work. ... sometimes you want to completely digest, master, live with the text. ... I'd like to just take two books and read and re-read them for a month like in grad school. The computer helps you cope with professional pressure [to produce papers in quantity].

The ways in which the computer changes the relationship between scholar and text, and between scholar and tools for working with the text, will be discussed in more detail later.

Two Cultures?

We have explored one particular value classicists hold, that of their relationship to the text. What can we say about classics more generally, and how members of this discipline view themselves with respect to other academic disciplines? One professor explains, "Classics is a humanistic discipline. It's a collection of culture and language. ... History, archaeology, each is justified in the sense that any of their elements are justified. Reading classics is as justifiable as reading any literature" (Classicist). The humanities include the branches of learning (such as philosophy, languages, history) that investigate human constructs and concerns as opposed to natural processes (the domain of physics or chemistry). They are often juxtaposed with the sciences; those familiar with C. P. Snow's 1959 lecture, published as *The Two Cultures and the Scientific Revolution* (Snow 1962), will remember the sharp distinction both in the approaches and in the goals of the two *types* of disciplines ("cultures," as he calls them) he draws between the humanities and the sciences. In many ways, a wide gulf does, indeed, exist between these two "cultures." Certainly there are many who view humanistic inquiry as *art*, not as science, and, as such, is something that can never be carried out or duplicated by a computer (Reedy 1988). "Human judgment and beliefs remain essential, not just morally, but even logically, if a system is to work in the real world. What can be done or what cannot be done depends, then upon the exercise of human judgment, to which computer systems must always be subjugated" (Ennals 1987).

However, metaphors from the sciences do crop up in classicists' discussions of their methods, goals, and data. Von Wilamowitz-Moellendorff (1982), for example, refers to the

science of classical scholarship. Some compare the process of classical scholarship to scientific research with scholars forming hypotheses and gather data to support them. A tool becomes a "first level device for gathering raw data" (Classicist) from which one can "develop further hypotheses that can be tested out" (Classicist). The notion of developing a hypothesis is particularly prevalent:

> . . . you set out a hypothesis and suggest certain kind of evidence . . . that supports it. (Classicist)
>
> [The TLG] was helpful in corroborating my hypothesis, and I would have been unable to make the point about the term with any confidence. (Classical Archaeologist)
>
> [My papers] are of a traditional type: read the documents; consider parallels carefully; consider other sources, contexts; form hypotheses; write the paper; see if it flies. (Classicist)

In part, the heavy occurrence of scientific metaphors may stem from classicists' working in a setting (colleges and universities) designed to reward the sciences (English Medievalist), and existing within a larger society which values science above art or the humanities.[15]

At the same time, scholars recognize that, in their field, there is no such thing as "proof" or conclusive answers.

> Most stuff is not "scientific," not quantifiable. (Medievalist)
>
> There is no absolute truth, but there are plausible arguments and implausible arguments. You're seeking for greater degrees of plausibility. (Hellenist)

In order to make such arguments, one must "know the text," and "have a feel for the author"— indeed, one must develop a subjective understanding of one's material. This, for example, is one reason that older scholars don't fear being overtaken by younger, more computer-literate scholars: they, with age and experience, have developed an intuition about their work than cannot be technically duplicated. Where does a computer fit in to all of this?

[15] Recall the above comment by a classicist that a fraction of the money spent on individual military programs such as *Star Wars* would be more than enough for all the Humanities combined. While his arithmetic may or may not be accurate, his assessment of funding priorities is correct.

3.2 Computing and the Humanities

Having now described classical scholarship, I would like to take a moment to very briefly present an overview of computing in the humanities. Various aspects of humanities computing, and more detailed histories of various computing projects, will be presented in future chapters. The intent is to provide the reader with a very broad picture in order that the individual elements, as they are filled in, will make sense as parts of a greater whole.

Computing use in the humanities is evident in a variety of ways. Current forms of information technology used in classics and other humanistic disciplines include personal computers, word processors, fax machines, bibliographic data banks, electronic card catalogues, on-line text systems, statistical packages, and more. Storage media can accommodate texts, hieroglyphics, musical notation, etc. Retrieval in simple text-based systems might consist of word searches alone while more complex databanks might allow composite searches including attributes of the text or author, syntactic information, and so forth. Manipulation can include the incorporation of data into texts for publication as well as statistical analysis (Bender and Briggum 1981) or the simulation of activities at archeological sites (Walsh 1981). Computer-stored texts can be made accessible *via* word-search programs or used to create concordances and other tools in traditional book form. And this plethora of technologies can be applied to either research or teaching efforts.

Many computer-based research activities are carried out through the use of personal computers. Coupled with word processing technology and perhaps a few other off-the-shelf applications, it can serve as a means to store notes, keep a bibliography current, prepare course materials, write and edit papers. As electronic mail via modem becomes more popular, it also serves as a means of communicating with colleagues and others. Desktop publishing abilities change the relationship between publisher and scholar, while emerging electronic communities affect collegial communication patterns. In recent years, on-line databanks have become available on CD ROM, accessible on a PC via a special ROM reader.

The most prevalent research-specific applications of computing in the humanities and in classics focus on the electronic storage, access, and manipulation of text. Some of the earliest projects in classics and in the humanities in general involved putting ancient texts onto mainframe computers and then compiling concordances from them.[16] Why this and not, for instance, focusing on the development of a databank containing excerpts of historical events or commentaries? There are two reasons for this: first, computers are ideally suited to such a task, as text can easily be numerically represented, stored, sorted, and so forth;[17] and, secondly, we have seen that the *text* plays a central role, and its accessibility and manipulation

[16]Concordances provide an alphabetical index of the principal words in a book or the works of an author with their immediate contexts.

[17]And think of how much easier it is to work with the sequential nature of text on one of the older mainframes!

is a key task for classicists. The early goal was to create electronically readable versions of texts that could be used to create traditional paper concordances or indexes. For the most part, it is only with the recent advent of the PC that users can directly access electronically-stored texts (the *Thesaurus Linguae Graecae*, described below, is the exception).

Computers play a role both in research and in teaching. While this dissertation focuses primarily on their use to support the former kind of work, the latter has played an important role in providing an impetus for the acquisition of computing equipment and the development of humanities-specific computer software. Though general purpose software such as text editors, spell-checkers, and the like, are useful in both domains, most special purpose software is developed either for research or teaching purposes. The reason is simple: undergraduates taking an introductory class (for example) have different information and interface needs than advanced scholars. For instance, a student looking up an unfamiliar word would most likely not only be satisfied with a brief and fairly simple definition or translation. Researchers looking up the same word would probably require a far more detailed set of information, especially if definitional nuances could make a difference in their answer to a question they are addressing.

3.2.1 The Computerization of Classics

There are a number of projects underway in classics that are specifically aimed at supporting the needs of the research community. This dissertation does not take a comprehensive look at all of these projects, though a later chapter discusses certain *types* of projects and certain *approaches* to tool building. However, two projects do bear mentioning here.

The first is the *Thesaurus Linguae Graecae* (TLG). The TLG is an electronic textual databank of Greek literary works under development and distribution at the University of California, Irvine. It is directed by Dr. Theodore Brunner and has the support of the *American Philological Association* (APA). It was one of the first tool development projects in classics and in the humanities in general, and was born in 1972 with a grant from the newly created *Packard Humanities Institute.* It was particularly visionary in that, in an age where the computer was viewed primarily as a vehicle for producing paper documents, the goal of the TLG was to provide direct access to electronic texts to scholars. As a pioneering effort, it also developed its own hardware and its own text encoding scheme. A set of other projects are creating on-line texts compatible with and distributed via the TLG Project (notably Michigan University which is encoding Greek inscriptions, and Duke University, which is encoding documentary papyri).

The other is the *Perseus* project at Harvard under the direction of Gregory Crane. Started in 1985, it is Macintosh-based. *Perseus* uses some of the TLG materials to provide databank access, but its conception goes far beyond being a mere databank. Through

the use of hypertext and multi-media, it is designed as a research and teaching tool with access to dictionaries, historical information, and on-line biographies. In some cases, visual information is coupled with textual information, either through the use of graphics (for maps or illustrations) or by means of videodisks. For example, using videodisks one can "walk" through the Parthenon or "view" a Greek vase. While this second project is the more conceptually robust one, the first is the more established and, in the long run, probably the more useful one in the general scholarly community. Once again, these two projects and other projects directed at supporting classical scholarship will be discussed in more detail in subsequent chapters.

Before closing this chapter, however, I would like to discuss the attitude of classicists— and of humanists in general— towards using these and other tools in their work. While there is tremendous interest in and use of information technology in the humanities, there is also a great deal of ambivalence about the impact they will have on the humanities and on "society" or "civilization" in general. The computer is seen alternately as aid and threat to scholarship. It is seen as embodying objectivity, as a revolutionary device, as a necessary evil, and as strictly a tool.

Those who consider the computer to be merely a tool view it as little different from a concordance, a dictionary, or some other traditional tool found in book form on the shelf or on the desk. At most, it can make things go a little faster or allow for access to a little more material, but there is no difference between this kind of improvement and that which could be obtained by working longer or harder at the task. Others have greater expectations. In a paper describing the (impending) impact of the *Thesaurus Linguae Graecae*, for instance, Brunner terms the TLG at "revolutionary" technology— it will "revolutionize" the discipline (Brunner 1988).

Unfortunately, it is very difficult to draw conclusions about the computerization of classics with any confidence. Discussions of the impact of computing on fields in the humanities in general have suffered from several problems. One is a focus on the purely technical aspects of computerization. Many descriptions of projects and computerization plans describe in detail the hardware and software that will be used, without considering the broader social or organizational changes that will accompany the introduction of computing (Lederberg and Uncapher 1988, Lerman 1984). Another shortcoming is the reliance on utopian and dystopian scenarios to express expectations and define impacts of computing without supporting empirical evidence. Finally, there is the more basic problem of defining *transformation.* Brunner (1988), for instance, bases his assessment of the TLG's impact on its utility in solving three very specific word search problems. Is this an example of a *transformation* of a *discipline*? In future chapters, I return to some of these issues as I try to assess the impact of computing on classical scholarship specifically, and on the humanistic disciplines in general.

3.3 Summary

In this chapter, I described the discipline of classical scholarship, using elements of the social worlds perspective. I drew on both readings and interview data to establish a picture of how classicists view themselves and their work. In order to do this, I focused on the questions classicists address in their work, and on the problems that classicists face in answering them. Finally, I presented the reader with a brief overview of computing in the humanities, and outlined two particular tool development projects in classics. The next chapter will discuss both pre- and post-computer tools, techniques and approaches that classicists use to carry out their work.

Chapter 4

Tools and Infrastructure

Exegi monumentum aere perennius — *Horace*[1]

In this chapter, I focus on the kinds of tools classicists use in order to carry out their work. These include "traditional" tools such as dictionaries, concordances, and indexes, and also newer electronic tools, such as databanks, word processors, and on-line library card-catalogues. Some of these tools are developed specifically for classicists, or even for a small group of specialists within classics, while others are malleable enough to provide general services that can be tailored for specific individuals. I review the kinds of activities that classicists carry out in their work, and describe the tools they apply to these tasks. I then discuss the factors that are important to the decision to make a tool or to buy and modify available tools or technologies, and propose a "package" metaphor for tool development and evaluation.

4.1 Tasks and Tools of Classics

When people carry out their work, what they do is engage in a set of *activities*. When they use "tools" in their work, they use techniques or artifacts that support these activities. Let's consider in more detail some of the kinds of tasks or activities that make up the work of classicists. Of course, these are many and varied: sharing ideas with colleagues, going to conferences, and reading books, writing papers are but a few. And a number of "tools," electronic and otherwise, are available to support these activities. For instance, both the postal system and the telephone— and, increasingly, electronic mail— support the sharing of ideas with colleagues.

In this section, however, I would like to consider a particular set of tools used to support the intensive interaction between scholar and text characteristic of literary scholarship.

[1]Horace was speaking of his own poetry when he said, "I have built a monument more lasting than bronze..." in 23 B.C.

> Scholars in the Humanities, particularly in such fields as philology, linguistics, history, philosophy, and literature have felt, virtually since the Renaissance, a profound need for complete lexicographical tools designed to facilitate the task of interpreting both literary and non-literary documents surviving from antiquity. (TLG Newsletter, special edition, 1973)[2]

Starting with this need in mind, let's look at one particular example of a problem in classics, and think about the kinds of activities that are carried out in the work process and the kinds of tools that facilitate the work. The following example is that of a classicist working on a book on allusion in early Greek tragic poetry. The scholar says,

> You see, there's no obvious or immediate way to go about identifying allusions. And, so, I began the way it always used to be, I read my text carefully and, whenever it rang a bell in my head and I thought I remembered a passage it alluded to, I would check it out. Fair enough, that word or those words or phrase might be in that other passage. But then you have to make sure; just because it's there in that passage, is it really an allusion to that passage? Where else might that word or words be? And there comes the rub. That would then entail just for the author, say Homer, taking the index or concordance to Homer, and checking how many occurrences of that word or phrase there are. If you find that it's unique in Homer then that's good enough.
>
> But then you need to check other places, so then you check, is it a rare word? You can start out with a dictionary. Sometimes that will indicate to you; but then, basically, you have to go to individual indexes and concordances for each author, and just see where all it's used, how it's used, if it's used very often. And it may be, when you're doing that kind of work, that you just might have a hunch, "I don't know for sure, this looks like a fairy unusual word to me in this passage, maybe this is an allusion." You start looking at it, first it looks good. But maybe you spend half a day, one of your good mornings when the working hours are great and you're bright-eyed, going through it, ruling out author by author and thinking you've been through it, and then all of a sudden you hit two authors and you find it's very, very common and it occurs all over the place, and it couldn't work as an allusion. It's a very laborious process that way. And one of the things that does to your work— because each search takes you so long, involves using so many books, so many concordances and indices, piecing them all together— you have to think of ways to be cost-effective. Your time is valuable and limited. You can only play out a certain number of your hunches, go with the best ones. [Constructed from an interview with a Classicist]

This is a fairly typical example of the tasks involved in constructing an argument. Let's break down some of the tasks this classicist carries out in doing so:

---

[2]The full title is, *The Newsletter of the Thesaurus Linguae Graecae*; Theodore F. Brunner is the editor, and it is published by the *Thesaurus Linguae Graecae* project. This form of citation is used for ease of recognition by the reader.

- making connections between different writers, ideas, words, texts, or passages;
- explaining the function of various elements of a text;
- looking for a particular piece of information or data;
- deciding whether or not a particular piece of information meets a set of criteria;
- deciding when it's worth doing something or looking for something, given limited time and resources;
- enumerating items or occurrences that fit particular criteria;
- combining information from a variety of sources in a coherent way;
- using the computer, books, going to the library;
- using two or more methods to check something out;
- dividing up the evidence gathered according to some kind of useful categories;
- and keeping track of all that information!

More broadly, in carrying out these tasks, the classicist is involved in **gathering evidence, making judgments** about that evidence, and **making connections** between items of evidence and, perhaps most importantly from a more pragmatic standpoint, **keeping track of evidence, judgements, and connections**. Clearly these are highly interrelated tasks.

Tools are developed and designed designed to incorporate or facilitate the work-related activities of classicists, and may make some activities invisible; judgments about the importance of various forms of data, for instance, may be implicit in the construction of the tool. As a result, tools can be said to embody some amount of judgment-making and connection-making, in the same was that artifacts can have "politics" (Winner (1980); see discussion in first chapter). For instance, one key activity around which tool development has centered is *searching*. Classicists have long worked at developing tools to support this primary activity, and several basic tools have existed for centuries now which aid the scholar in locating words, phrases, names, or even concepts within a text. These basic tools have traditionally consisted of dictionaries, indexes, and concordances. Over the past few decades, on-line databanks have begun to join their ranks. These tools, which facilitate search activities (part of gathering evidence), also have more or less judgment- and connection-making built into them. Indexes, for instance, list only the "important" words— in some person's eyes; dictionaries provide supplemental notes that may contain links to literary references or linguistic information. Electronic tools may also have built-in mechanisms for keeping-track of evidence. In many cases, electronic databanks allow users to save the results of on-line searches in a file, either on a hard disk or floppy diskette (though the use of 3×5 index cards is not yet dead). This complex tie between work activities and tools will become more transparent as I describe the tools used by classicists.

4.1.1 Into the Text: Search Tools and Techniques

> Anyone who has used both 'Index' and 'Concordance' will not hesitate to acknowledge that if the 'Index' is good, the 'Concordance' is better. (Prendergast 1962)

What tools and techniques are available to the intrepid classicist, venturing into the Depths of The Text?

The human eye. The most primitive method for locating a word or phrase is, of course, simply scanning the text with the human eye. When no other tools— no concordance, for instance— existed for a particular text or author, this was often the only method available to the scholar. The interested individual would literally scan the text, marking all the relevant words or passages with a pencil or noting them down on a piece of paper. This is still the only way to search through texts that haven't been entered for on-line use yet, or when the pattern of interest cannot be specific in a computer-recognizable form.

The index. Perhaps the simplest tools is an *index* to a given author or work. This index could be an index of all words in a text, given, for example, all the locations of the word for "shield." The user must then find the location of the word within the text in order to see the context within which it occurs. Indexes will rarely include words deemed unimportant, such as articles, nor will they usually includes the locations of entire phrases. Some indexes are limited to the names of places or people, such as an index to the "matters and names contained in the dialogues of Plato according to the pages of Stephens' edition" (Abbott 1971). As with concordances (the next tool under discussion), they vary greatly in completeness, quality, and utility. A poorly done index is often worse than no index at all, as one cannot make claims based on its information with any sort of authority.

The concordance. During the 19th century, particularly in Germany, numerous *concordances* were compiled. Concordances differ from indexes in that they tend to include some context for the word, perhaps even a definition or translation. Again, the selection of the words to be included in a concordance is up to the editor, as are various points about the arrangements or groupings of the words. Computerized texts are now making it easy to generate one form of concordance, referred to as a "*k*ey*w*ord *i*n *c*ontext," or KWIC, concordance. Each word is ordered along strictly alphabetical lines, and printed with some context on either side. For instance, given the words "was" and "were," all occurrences of "was" would be listed before all occurrences of "were," with occurrences of "water" in between. A more sophisticated concordance (one with far more intervention on the part of the editor) might list all occurrences of the verb "to be" together, grouping occurrences of "was" and "were" in one place. Within a word group (say, the word "shield"), a concordance might also group together all instances of "shield" appearing at the beginning of a line, at the end

of a line, or in the middle of a line. Again, the locations of phrases are not included in a concordance. As with indexes, concordances are generally created specifically for one work or one author's canon. We have, for instance, a concordance to Homer's Iliad (Prendergast 1962), and a complete concordance to the works of Flavius Josepus (Rengstorf 1983). And, as with indexes, their quality varies considerably.

Dictionaries. While concordances and indexes are designed to provide an exhaustive listing of the words, concepts, or locations within a single text or author's corpus, the function of a dictionary is quite different. It focuses on a particular type of information, and is more likely to be exhaustive historically (listing all the different shades meanings of a word over time), than physically (listing all the locations where a particular meaning occurs). The efforts of scholars provide us with dictionaries of ancient Greek coins (Jones 1986), Roman and Greek antiquities "illustrative of the industrial arts and social life" (Rich 1890), and, of course, Cassell's famed Latin dictionary, with quotations illustrating word usage (Simpson 1960), much the same as we find in the *Oxford English Dictionary* (Simpson and Weiner 1989).

Bibliographies. Finally, a discussion would not be complete without a mention of the importance of bibliographies, which enable the scholar to locate the contributions of others who have written on a particular author for work within a given timeframe (McKirahan 1978, Saunders 1979). One of the most important reference tools for classicists is the annual *L'Annee Philologique*, begun in 1924 and published regularly since 1928, which yearly lists all books, articles, and reviews published in the field of classics, grouping them by author and by topic. However, with the exception of the *L'Annee Philologique*, currently in the process of creating a CD ROM version for distribution, electronic bibliographic systems designed specifically for use by classicists have not appeared. Classicists, however, do have increasing access to electronic card catalogues and bibliographic systems developed for general use.

Limitations and difficulties. Concordances, indexes and dictionaries clearly have certain limitations. For one thing, their creation presents an enormous investment in time and energy. The traditional method for building an index, for instance, was to make out a slip of paper for each word in a text and note on that paper each location of that word. The more critical material was to be included, as in the case of a concordance or dictionary, the more effort was involved. In any case, this style of preparation was exceptionally error prone, both during the manual scanning process and in the subsequent recopying and printing processes. Indeed, for many Greek and Latin texts and authors, no lexographical tools exist.

4.1.2 The Electronic Age

When classicists (and humanists in general) began to consider the contributions that computers might make to the discipline, the creation of lexographical tools headed the list. At first, however, computers were seen primarily as a means to assist in the creation of traditional concordances and indexes. Projects to harness the new electronic technologies can be traced back to 1949 when Jesuit Father Roberto Busa began his work on the *Corpus Thomisticum*, a machine-readable version of the text of Saint Thomas Aquinas, in conjunction with researchers at IBM's Thomas J. Watson Research Center. Data entry was not completed until 1967 and another thirteen years were spent in text verification and data processing tasks that led to the production of a sixty-volume, 70,000-page concordance to the works of Saint Thomas in book form (Brunner 1989; see Busa 1980 for complete texts and indexes).

The next major effort was begun in 1957, when John Ellison converted the Bible into electronic form and published a (book) biblical concordance. During much of the 1960s, individual scholars created machine-readable versions of classical and other authors. The first computer-based studies of Homeric texts, for instance, took place in the early 1960s (Classicist). By the time IBM sponsored the first conference on literary data processing in 1964, many of the 150 attending scholars were already engaged in computer-assisted research in all areas of humanistic research (Bailey 1981).[3] These projects were also fairly small in scale, as they centered on a specific author or text and were accessible mainly to a small, computer-literate, and local community. When American Philological Association began sponsoring a repository of classical texts in machine-readable form in 1969, housed at Dartmouth College (Waite 1971), its manager discovered that neither could the quality of the texts be guaranteed, nor was there a standard tape format. Virtually each individual converting Greek texts to machine-readable form used her or his own personal data entry conventions. These problems carried over into the published products created from these machine-readable texts. When a COBOL concordance-generating program appeared in early 1970, Widmann (1971) commented, "The tribe of concordances and indexes, ever-increasing, varies in quality and subject matter."

Again, at this time, computers were still seen primarily as a means of creating better traditional tools in book form, rather than as a means of direct access to the texts themselves (Brunner 1989, Waite 1972, Widmann 1972). Projects were small in scope and limited in ambition. In 1972, the *Thesaurus Linguae Graecae*, would burst on the scene to become the first effort to put complete texts on-line, to provide *direct* word search capabilities, and to propose to do so for the entire corpus of ancient Greek literary texts. We shall discuss various aspects of this project in more detail below.

[3]The hardware and software these early scholars used would leave us much amazed these days: Leonard Brandwood of the University of Manchester, for instance, completed a Plato concordance (Brandwood 1976) using a computer with only 16K memory (Brunner 1989).

As the 1970's progressed, advances in computer hardware and software provided classicists and others with smaller, faster and cheaper machines. The next big "breakthrough," however, did not occur until the early 1980's when personal computers (PCs) came on the market, importantly, with software and hardware that could support user-defined hierarchical structurings of information (notably the Macintosh and hypercard). This spurred on the development of tools different in kind from traditional tools used by classicists, but more closely allied to the larger context of their research activities. In order to clarify this point, allow me to consider certain features of the two kinds of tools, described in more detail below, and their relationship to the way classicists carry out their work.

4.1.3 New Tool Strategies

Computer-based tools seem to follow one of two approaches, both of which are extensions of traditional modes of research. The first emphasizes search capabilities for accessing the text; the second focuses on intellectual branches between the text and other texts. For the purposes of this discussion, let me call these the intra-text and extra-text approaches, respectively.

Consider the following example, derived from a set of interview data, and its presentation of the broader scope of activities contributing to the construction of a research question and an argument based on the text.

> The idea for this project came from a class I taught. Somebody asked me a question that I couldn't answer and I chased the subject through the L'Annee Philologique. I came up with only one book written in the 30's and not really dealing with the subject at all. So, I decided that I would try to answer the question myself. When I started this project, the first thing I did is to re-read the text. I read the text a lot, and I read around very extensively in social history and intellectual history.
>
> Our library isn't really good for browsing. We have two different systems for cataloguing, and books that aren't used a lot they send out to some storage location. But now they have terminals in the library, so that's great. The computer links all the books together because you can look them up by topic, no matter where they are, and browse on the computer. But anyway, that's just an aside.
>
> So, there were certain concepts I was interested in and I wanted to see how they were used by other Greek authors of that time. So what I would do is look for these concepts; I'd look in the text itself and in these others authors. That's when I'd use the computer to search for words or phrases that were related to concept I was interested in. I'd start the search, come back and get the printout, and meanwhile I could be thinking about what I'd found the day before. [Constructed from interviews with five Classicists]

Note that there are two kinds of "directions" in which one looks for information in this example. In some cases, one is looking "into" the text itself, searching for words or phrases.

In other cases, one is looking "out of" the text, to other sources of information. Let's compare the tools that support these two kinds of tasks.

The Intra-Text Tool Approach

Some of these tasks involve the texts themselves. One task, of course, is reading the primary texts to be used. Others involve examining parts of a text more closely with some goal in mind: "I'd look in the text itself and ... search for words or phases that were related to the concept I was interested in." These are exactly the kinds of tasks that traditional tools, such as indexes and concordances, are designed to serve.

This is also the first realm of activity for which classical scholars turned to the computer as a tool. As discussed above, most early tool building efforts focused on the creation of electronic versions of texts and some kind of accompanying search or concordance-generation generation program.

The *Thesaurus Linguae Graecae* (TLG) is a prime example of this kind of tool. It is a repository of Greek literary papyri which allows the user to perform extensive searches one single text or a set of texts. However, it it not designed to include either critical materials for a given text or to provide information about secondary sources. The TLG will be discussed in more detail below, not only in terms of the features it provides, but in terms of its role in the classics community.[4]

The Extra-Text Tool Approach

Note, though, that a number of the activities in the example above don't involve the primary texts, but rather involve looking at a variety of secondary literature.

> ...I chased the subject through L'Annee .... I read around very extensively in social history and intellectual history.

With the advent of hypertext and multimedia systems, classicists have begun to think about exploiting new technical possibilities to provide a set of tools that support these kinds of research activities. Some are already under development, such as the Harvard *Perseus* project, discussed below. These new tools provide two kinds of facilities. First, they serve as bridges between various existing tools or capabilities; for instance, from my computer workstation in my office, I can also use an electronic mail package to communicate with people next door or people overseas, and a moment later, I can "browse" the stacks of the library via access to the on-line card catalogue. Secondly, they create direct links between different kinds or

[4]Hughes (1987) provides a brief but thorough overview.

sources of information, for instance, enabling a user to call up dictionary entries, pictures, or graphical representations for discrete elements within a text.

The *Perseus* project at Harvard, under the direction of Gregory Crane, represents an extremely ambitious instantiation of this approach. It is one of the most ambitious and most advanced systems directed specifically at students and faculty in classics.[5] The goal of the project is to provide "interactive sources and studies on ancient Greece" via a multimedia database that includes links between texts and images on an optical disk. The project description reads,

> Students of Classical Greek civilization are faced with many diverse materials that are not easily integrated in traditional scholarship. For example, the Bacchae of Euripides cannot be fully appreciated unless the reader is familiar with the way in which satyrs and maenads are portrayed in Greek art. The histories of Herodotus and Thucydides are clearer when illustrated with many maps and photographs of the places they mention. And it is much easier to read a Greek text in the original when it is accompanied not only by an English translation as in some printed editions, but by a dictionary and a program that can parse Ancient Greek word forms. (Crane 1989)

As opposed to the TLG and other tools, which provide strictly on-line texts for search purposes or concordance generation, *Perseus* also contains the translations of texts, some of which are accompanied by an *apparatus criticus* and by other textual notes. It contains a set of video images, an atlas of topographical maps annotated with toponyms, still and moving images of sites all over Greece, a historical overview, and a classical encyclopedia.

> The historical overview is a chronological narrative that will have links into the primary material. Encyclopedia articles will also terminate in links to other parts of the database, so that a reader can use a topical as well as a chronological approach to the information. (Crane 1989)

While directed primarily at students and teaching environments, the project sees itself as also providing materials for use by faculty members.

First releases are just barely out in the field, and it is too soon to tell what kind of an impact *Perseus* will have in the long run— or even the short run. However, some problems and difficulties are already apparent, and will serve to explain why individuals are more excited about the promise of the TLG than about the promise of *Perseus*. They will be discussed in more detail below, and center around the difficulties of selecting and assembling the data for inclusion. Apropos this topic, I will now discuss some of the broader issues associated with the creation of tools.

[5]More "generic" efforts include Apple's *Knowledge Navigator*, intended to provide access to databases, combine remote and local data for analysis, schedule appointments, and assist professors with a variety of academic tasks (Bellin 1989); and MIT's *Project Athena*, which is designed to provide similar kinds of access to students, as well as link them to a campus-wide electronic mail network (Lerman 1984).

4.1.4 The Role of Tool-Building Within Classics

Creating traditional tools, particularly in the pre-computer days, entailed time-consuming work requiring enormous attention to detail. Often, this work took place over a number of years. Consider the following excerpt from the preface to a concordance whose acquaintance we made earlier in this chapter.

> This 'Concordance' to 'Homer's Iliad' has been compiled from Priestley's Edition of Heyne's Homer, published in 1834.
>
> > It was commenced on June 5, 1847.
> > It was completed on October 18, 1863.
> > The printing commenced in July 1868.
> > It ended on November 9, 1874.

Note that the concordance was in progress for *more than 27 years* before the printing was complete.

Why do this, then? Why spend so much time and so much energy on such a tedious task that will not necessarily be rewarded? Sometimes, the impetus is personal work. Perhaps one needs a concordance to a particular author whose texts one uses in one's own work. How to justify it? Tool building is such an integral part of "what classics is about" that little more than the lack of a concordance or a critical edition is needed to justify the work. Consider the opening sentence to the preface of a concordance to Statius: "The need of a Concordance of Statius requires *no demonstration.* Nothing approaching adequacy in the way of an index, to say nothing of a concordance, exists for this author whose literary influence through the ages has been at least noteworthy.

At the same time, tool-building can be a somewhat marginal activity within the discipline under some circumstances. Creating a concordance or an index isn't quite considered to be "real" scholarship the way that preparing a new edition or writing a book might be. On tools and "real scholarship," two scholars offer the following remarks:

> Everybody uses them, no one recognizes the person who did them. Some resent people for doing them because it's not as highly regarded as detailed analytical work." (Project Staff Member, Classicist)

> Books are the highest, especially ones dealing with some kind of an idea. Doing an edition is way up there because it takes special skills, it's regarded very highly. It's an honor to be commissioned to do one by one of the publishers who puts out series of editions of classical authors. Books are highest on the scale. Articles are just things you make into a book. The *Thesaurus Linguae Latinae* is more

> highly ranked than doing a concordance or an index because you are doing lexicographical work. (Latinist, Worked on *Thesaurus Linguae Latinae*)[6]

The scale in figure 4.1 might be used to illustrate the various "rankings" of different forms of traditional scholarly activity. The last four items (preparing a new textual edition, writing a commentary, writing a book on an idea, and writing books in general) are pretty much grouped closely together; where they would fall depends a lot on content, level of quality, and intended audience.

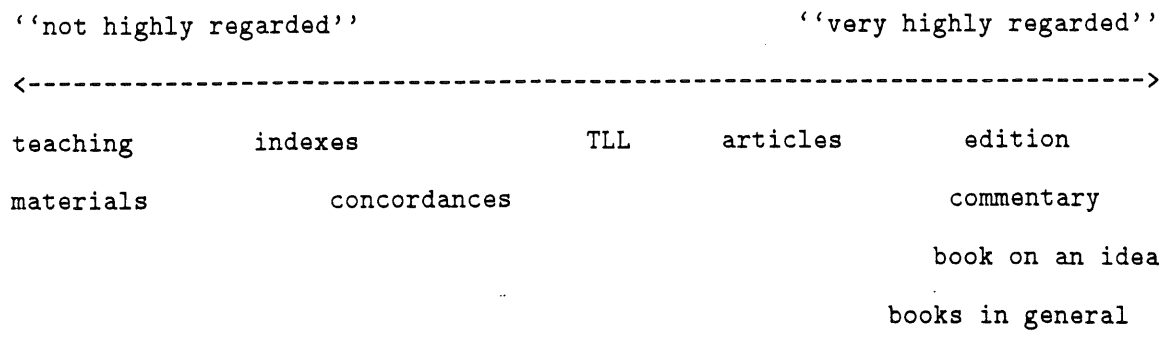


Figure 4.1: Relative rankings of forms of scholarly activity.

The lack of recognition for tool building seems to be especially acute when the tools are computer-based, as evaluators aren't always sure just what to make of this new and unusual form of disciplinary activity, and it isn't clear whether or not such activity constitutes "scholarship." Says one tool builder,

> Creating tools is doing the "dirty work." There are decisions that have to be made, there is hard work involved. I'm not in trouble, I'm a full professor ... but there is one ilk on campus, they don't see this as the "most reputable work" in classical studies. When you're doing something like working on a databank, you don't have time to do interpretive work. (Classicist, Full Professor)

These sentiments are echoed by another tool builder who maintains that he is judged by the "traditional scholarship" he produces, not by his work on a tool for research and teaching. This was particularly true in the late 1960's and early 1970's, when computing was not only non-traditional within the discipline of classics, but was still in its early, experimental phases in its own discipline, when "... young humanists experimenting with computers often

[6]The *Thesaurus Linguae Latinae* (TLL) project, currently based in Munich, Germany, is developing a lexicographic work for Latin that identifies each individual word according to its appearance in variuos authors, its semantic meanings and shadings, and its historical and linguistic development; it is discussed in more detail in the next chapter. This informant spent a year on a fellowship working at the TLL, and is currently transforming his dissertation into a book. He does not yet have tenure.

had to face the disdain (if not the ire) of senior colleagues of a more conservative and less adventurous persuasion, and ...paid a dear price for his or her involvement in computing when tenure decision time rolled around" (Brunner 1989). Judging by these comments, one might be tempted to rank projects such as the TLG somewhere along with traditional indexes and concordances.

Slowly, however, institutions are recognizing the role and contributions of tool-building projects. At UC Irvine, for instance, the TLG was recently granted status as an *Irvine Research Unit*, falling under the purview of the UC Irvine Office of Research and Graduate Studies. It has also moved to more spacious quarters in a new building, always a status symbol on space-hungry campuses.

4.2 Metaphors for Tools and Tool-building

So far, I have discussed tools and tool building within classics from the perspective of their relation to the texts and the kinds of information they provide about the text. However, there are other ways in which one can talk about tools, about their creation and utilization, and about their role in their community of use. Certainly, a tool's physical features or technical characteristics are of interest to some. As a printer or editor publishing a concordance, the quality of a paper, the complexity of a layout, and the readability of a font are of critical interest to me. When purchasing a personal computer, I want to know the speed of the processor and the size of the memory. However, the physical (or, these days, the electronic) artifact which we term a "tool" is more than that. It is one component of a complex *package* which include not only physical equipment (the box, the hardware), but also assumptions, techniques, resources, infrastructures and even diverse user communities.

Kling and Scacchi (1982) discuss the differences between two views of computing: the *discrete-entity* or *tool* model is contrasted with the *package* or *web* model. In an earlier paper, they characterize these two views in the following way:

> The tool metaphor ...suggests that the item denoted may be used with few attendant problems ... [and that] one can safely focus on the device to understand its use and operation. In contrast, the package metaphor describes a technology which is something more than the physical device. In the case of computing, the package includes not only hardware and software facilities, but also a diverse set of skills, organizational units to supply and maintain computer-based services, and data and sets of beliefs about what computing is good for an how it may be used efficaciously. (Kling and Scacchi 1979)

They identify a set of structural concepts of computing,[7] discussed in more detail below, upon which I draw to suggest a set of questions about or requirements for the development and use of computer-based tools within classical scholarship. Combining elements of the web model with elements of the social worlds perspective, I apply the package metaphor to the traditional concordance before discussing newer, computer-based tools.

Any tool must address a fundamental need of classicists; it must support some activity central to the work they do. Gerson (1983) refers to people's *line of work*, or what they actually do in a job (as opposed to formal job description); and Hughes (1971) describes organizations in terms of their *going concerns*, the multiple, often overlapping, and sometimes even conflicting activities which characterize collective lines of action within organizations. Both the creation and the use of a tool must be supported by an appropriate infrastructure. This infrastructure may include resources such as funding, personal expertise, distribution mechanisms, and skilled staff, as well as any physical equipment or systems. When tools are computer-based, other resources become critical. For instance, the availability of appropriate and accurate software may be a key resource, and low-noise communication lines or adequate electrical power (not always a given in very old buildings) may constitute critical physical systems.

Since tools are created to support some kind of activity, they also require mechanisms for making decisions about the tools themselves. These could be project-based (with the creators making decisions about tool structure or content), but could also involve members of the user community either as individuals or through membership in professional organizations and on editorial boards. Feedback from the community must be further channeled into mechanisms for refining the tool. Conventions within the target community support the creation of tools by eliminating decisions that must be made. Standard formats for representation of information, the use of standard notation systems, and unspoken agreements about content all have the potential to simplify the tool developer's job. New kinds of tools, however may challenge former conventions, just as new modes of musical expression may require their own notation systems or even new and unique instruments (Becker 1982).

One set of conventions dictates the division of labor within an activity or set of activities; long-established patterns for the creation, distribution and dissemination of artifacts may specify interactions between individuals and the tasks for which they are responsible (Becker 1982). Kling and Scacchi (1982) term this a *production lattice*, referring to the different elements contributed to some final product by different groups in different organizational locations.

Finally, developments outside the social world within which the tool is being created, the *macrostructure*, may profoundly affect that tool. This is equally true of organizations or formal organizational units. Cuts to a university library's budget may affect the purchase

[7]These are: lines of work and going concerns; infrastructure; production lattices, and macrostructures. This conceptual framework forms the basis of a web analysis.

of new reference works for classicists, just as university-wide computing policies may affect the purchase of hardware or the availability of consulting services. And hardware developments within the computing community may profoundly alter the potentials for developing computer-based research tools. Often, both tool builder and user stand powerless to influence these larger processes.

4.2.1 The Concordance as Example of a Package

We have already considered the concordance as a tool for locating certain kinds of information within a text. Now, let us consider the concordance as part of a larger "package." And let us use as an example Prendergast's concordance to Homer's Iliad, already mentioned above (Prendergast 1962), which I located in the UC Irvine main library using a card catalogue. I begin with a few excerpts from the original preface to the November 1874 edition.

> This 'Concordance' to 'Homer's Iliad' has been compiled from Priestley's Edition of Heyne's Homer, published in 1834.
>
> ...When I resolved to print my manuscript, I enquired, from the Rev. John Wilson, D.D., Vicar of Holy Trinity Church, Knightsbridge, whether he could assist me to find a person who would undertake the correction of the proof-sheets as they passed through the press. He recommended his nephew, and curate ...who has kindly corrected for me the press— comparing, also at my request, my manuscript with Seber's 'Index Homericus.'
>
> I was asked, in March 1869, casually, whether I had used Seber in compiling my 'Concordance.' I replied that *could not* be, since I finished my 'Concordance' on October 18, 1863, and my first acquaintance with Seber was on April 7, 1864, on which date I purchased a copy of Seber's 'Index Homericus' at a book-stall in Cheltenham.
>
> ...I began my 'Concordance' with the idea that it would be of use to Public Schools .... Hence the work extends beyond the dimensions of an ordinary 'Concordance,' which requires so much only of a line as will enable the enquirer to identify readily any desired passage.

Let's consider the various components of a larger "package" that come into play in the above example. The concordance has a definite place in the classics community: first, as a research tool, but also as an aid for teaching the Greek language and preparing the next generation of scholars. A concordance such as this one supports work in literary analysis, which contributes to the larger work of expanding the range of knowledge about ancient civilizations. This concordance provided an essential tool for use with a particularly renowned Greek poet, Homer.[8]

[8]In the words of one classicist, "Homer, he's where it all starts." He attributes this statement to Carmen Lacertae, a multi-tentacled comic strip character of his own devising.

In the case of traditional tools such as concordances, publishers, booksellers and libraries form important infrastructural components as mechanisms for distribution and dissemination. Note the reference to interactions with the publisher in terms of correcting page proofs, and with the bookseller in Cheltenham. Libraries, in particular, provided the means by which classicists can access such tools free of charge; key reference works, such as this concordance to Homer, are likely to also be found in departmental classics libraries.

Conventions help dictate the format of a concordance. A "minor" convention is, of course, the alphabet— without an agreed-upon ordering of information, tools such as concordances would have been impossible to either use or create (Eisentstein 1979). Other conventions include the method of citing a particular work (the TLG *Canon* (Berkowitz and Squitier 1986) notes the various citation systems. In this case, the standard citation for Homer includes the book number, the section number (in the form of a Greek letter), and the line number.[9]

For traditional tools such as concordances, professional organizations and the editorial process can also provide guidance in data selection and tool creation, though sometimes at a much "higher" level. User comment and guidance could be reflected in future editions or sheets of *errata*. In this example, someone else's edition of yet another person's edition of Homer served as a basis for the concordance, while the index to Homer created by yet another party was used for verification purposes.

The tool builder's job is made both easier and harder by long-established traditions in classical scholarship: easier in that fewer decisions have to be made if one chooses to follow the prevailing conventions; harder if one decides to develop a new way of doing things, or to meld both the traditional and the new. We will take up this idea again in the next section, as we discuss the TLG in more detail.

4.2.2 The Future of Tool Creation: Build vs. Buy

The TLG is an intensive and impressive project; it has mobilized vast resources and has literally set the pace for a major component of tool building activity in classics. Even as certain components of the TLG, such as the Ibycus, become less important and less used within the classics community, the TLG's role as a central archive for Greek texts will not be diminished. The same can be said for other projects and centers involved in assembling machine-readable texts. The final chapter discusses the emergence of larger initiatives, such as the cross-disciplinary development of standards for text encoding in the Humanities, and the ramifications for the TLG and other current projects.

[9]You'll find ˘*ακουη* at 2(*β*). 200.

As software becomes more available, people will begin to buy their own components. For instance, there now exist several concordance packages, such as the Oxford Concordance Package, which require the user to merely supply the text in machine-readable form; the package itself does all the rest, the user supplying parameters of interest. What's more, classicists will push for compatability between tools and popular or standard personal computers (as will other humanists). However, there are some things that will never be available "off the shelf," and this includes components of the TLG "package" such as its mechanisms for large-scale data entry, correction and verification of texts, dissemination and updating of materials, and so forth.

4.3 Summary

In this chapter, I have focused on the kinds of tools classicists use in order to carry out their work. These include "traditional" tools such as dictionaries, concordances, and indexes, and also newer electronic tools, such as databanks, word processors, and on-line library card-catalogues. The particular focus has been on this latter set of computer-based tools, both those developed specifically for classicists, and those designed to be more general tools that have been adopted by members of the classics community.

This chapter was *not* meant to provide an exhaustive list of all database projects or machine-readable text encoding projects. Instead, its goal was to give the reader a flavor for the kinds of tools that classicists use in their work, some of the issues that tool developers face in their various undertakings, and an understanding for the larger context within which these tools are developed and used. Those tools which have become or are destined to become important and widely used are not merely those which support the research activities of classicists, but those which are presented to the community in such a way that their incorporation into that community and into the activities of the individual are facilitated by enough, if not all, aspects of the project "package."

Chapter 5

The Thesaurus Linguae Graecae as Case-in-Point

> Man is a tool-using animal. ...Without tools he is nothing, with tools he is all.
>
> — Thomas Carlyle, *Sartor Resartus*

In this chapter I describe in greater detail the development of the *Thesaurus Linguae Graecae* (TLG), a databank of Greek literary texts. I not only cover the history of the project, but also describe its relationship to other tool development projects within classics. I examine the fit between the TLG and work of classical scholars by considering how it helps them solve specific problems. The package metaphor outlined in the previous chapter will serve to explain the success of the TLG despite its many problems and shortcomings.

5.1 A Briefe Historie of the TLG

I wish to devote the second half of this chapter to a more in-depth look at one particular tool, the *Thesaurus Linguae Graecae*, or TLG. We have already touched on various aspects of the TLG in the earlier discussion, but it behooves us to look more closely at a tool which has had a profound effect not only on research conducted in classics, but also on subsequent tool-building efforts within the discipline. After presenting some of the history behind the TLG, I would like to further develop the TLG "story" along the lines of how it works as a package: how the various components of the TLG serve to make it successful within the classics community.

Professor Theodore F. Brunner has devoted a good 20 years of his life as a scholar to the development of the *Thesaurus Linguae Graecae* (TLG), a databank containing texts and

documents surviving from ancient Greece.[1] The project began in 1972, when Prof. Brunner first started exploring the potentials for computers as research tools. By the late 1980's, the TLG databank contained approximately 62 million words (of an estimated total of 90 million words) constituting all ancient Greek texts and documents surviving from the period between Homer (eigth century B.C.) and A.D. 600, with fifty percent of these texts verified, corrected, and available for scholarly use.[2] In the following sections, I describe the history of the TLG from its inception in the early 1970's to its current secure position in the realm of tools for use by classical scholars.

5.2 The Thesaurus Linguae Latinae Connection

Classicists over the past few centuries have repeatedly considered the creation of lexicographical works for both Latin and Greek that would identify each individual word according to its appearance in various authors, its semantic meanings and shadings, and its historical and linguistic development. The framework for such a project in Latin literature was established towards the end of the nineteenth century, resulting in the creation of the *Thesaurus Linguae Latinae* (TLL), initially based at the University of Leipzig, and subsequently moved to the Bavarian Academy of Sciences in Munich. Scholars estimate that approximately nine million words[3] will need to be assembled, investigated and catalogued; each word will be precisely defined within its literary and temporal contexts. At present, the TLL is complete through about the letter "O," and it is anticipated that work will continue well into the twenty-first century. Although the project is now incorporating computers into its operations, for most of its life, data-gathering techniques were limited to the use of manual recording procedures (ie. hand-written entries on roughly nine million 5"-by-7" slips of paper, one for each Latin word to be analyzed). Because of the cumbersome nature of these operating procedures, all interpretive work had to be performed on the premises of the institute where the card file was located. This, in turn, limited the number of scholars who could be engaged in the process of interpreting and defining the material at any given time.

Why not do the same for the Greek language? Certainly there has been an interest and activity centered around the construction of a Greek Thesaurus for literally centuries. The

[1] Material for this chapter is primarily taken from a series of interviews with Theodore F. Brunner (director of the TLG), members of the TLG staff, and from project documentation and publications. One key set of documents are the Project Newsletters, which form the primary means of communication between the TLG project and the rest of the classics community. They were published on an irregular basis from the first Special Edition in 1973 to the most recent one, number 18, published in January 1991.

[2] A *word* is exactly that: a word. This doesn't mean the number of distinct words. For instance, the saying, "bis dat qui cito dat" [He gives twice who gives promptly] contains five words total, not four, though it contains only four *distinct* words. The reason for this method of counting will become apparent in the next section.

[3] Estimated at the time to be one-tenth the number of Greek words.

first Greek thesaurus was the result of two decades of labor on the part of Henri Estienne.[4] His work was essentially a "mammoth lexicon," unlike a modern thesaurus which also lists synonyms and antonyms (for instance), in which he cited and defined in Latin every ancient Greek word known at that time. Renaissance rediscoveries of long-lost classical texts soon rendered his painstakingly constructed thesaurus out of date (Brunner 1988). With few new texts being discovered anymore, why not now establish a *Thesaurus Linguae Graecae* along the lines of the TLL? Consider the fact that before it is done, the TLL will have been the focus of a concerted scholarly effort for perhaps a century and a half; given that the Greek corpus is estimated to be about *ten times* the size of the Latin one, as long as manual data collection were the only form of data collection available, this project was considered to be infeasible.

Before continuing with the history of the TLG, I wish to include one note about the two projects. Although the names are similar, the TLG and TLL are no longer two "branches" of the same project. Not only are they funded differently and directed by different individuals, but the construction of the TLG is quite different in nature from the TLL. The TLG simply provides the texts of literary documents, and software for searching those texts for particular words and phrases. This will be discussed in more detail later. Nevertheless, the *impetus* for their inception and continuation is shared.

5.3 The TLG vision

> ...the TLG was a path finder. It changed the way in which people work, changed the way in which they allocated budgets so they could buy computers. The TLG was like an ice-breaker. It changed the field at the level of infrastructure, the level of what you spend money on. You now have to have space for the computer; you now assume the computer is going to be part of your day-to-day work. (Tool Developer)

Prof. Brunner began formulating his vision for the TLG in the early 1970's. At this time, the potential for computing was not yet apparent to the majority of individuals in the discipline. Those involved in computing were truly on the "cutting edge."

> I ran across articles in late 1971 about databanks created by the CIA, the IRS, airline companies. I suddenly realized that computers could be used for things other than numbers, names, letter-based information. I came to the conclusion that instead of using manually written pieces of paper, use the computer! That's the fundamental decision that led to the TLG and to its success. (Ted Brunner, TLG Director)

[4]Known also by his Latin name, Stephanus, and referred to in an earlier chapter by von Wilamowitz-Moellendorff (1906).

At that point in time, he was a classicist by trade and training, with an avocation for shortwave radios, but neither technical background nor experience with computers. He did, however, know a person who was to become a key figure in this enterprise: David W. Packard, a classicist with a Ph.D. from Harvard, the son of one of the founders of the Hewlett-Packard Corporation, who was in a position to offer financial support to an experimental project in tool development within Classics. In the course of completing his Ph.D., Packard had created one of the first and most extensive computer-generated keyword-in-context concordances to the works of the Latin author, Livy (Packard 1968).[5] With a grant of $25,000 from David Packard, Brunner began to learn about computing, to travel to Munich and observe the methods used by the TLL project, and to bring to UC Irvine others in the classics who had dabbled in computers. Of these activities, Brunner says,

> It was during that period that I concluded that it couldn't be done with old methodologies. ...[As for others who had used computers,] the problem with all of them is that all of them had dealt with relatively small amounts of text, single author single work. The amount of material they had to convert into electronic form was so small that they could do data entry themselves. They could keypunch over a couple of months, write their programs, create a KWIC [keyword-in-context concordance]. The work they were doing was all done for their own specific individual research. ...I was confronting something completely different .... (Ted Brunner)

Developers of traditional tools such as concordances could benefit from already established mechanisms for creation and dissemination. For instance, when Henry Dunbar created his concordance to Aristophanes in the late nineteenth century (Dunbar 1883), there existed a publisher— Clarendon Press at Oxford to handle the details of printing it, there were book sellers who would market it, and there were libraries such as the Bodleian Library at Oxford University which could purchase the new concordance and make it available to students and faculty. If a databank were to be used not merely by one or a few individuals, but was to be widely disseminated and be part of a long-term, on-going effort, similar mechanisms would have to be established. According to Brunner,

[5]Director Ted Brunner also had the good fortune to be offered no less than one million dollars of support from Marianne McDonald, a graduate student in classics at UC Irvine at the time, who wrote her dissertation on terms for happiness in Euripides (MacDonald 1975; this is the only reference to her anywhere with this spelling). Dr. McDonald is also heir to the Zenith Television Company fortune, and originally donated the money anonymously. In the 1982 *TLG Newsletter*, she was identified as having contributed $1,339,000 to the project over the years (toppoing the National Endowment for the Humanities' $1,141,000). She has continued to be one of the TLG's most most constant benefactors, though the amount of individuals' contributions are no longer made public.

Dr. McDonald also created some of the first semilemmatized concordances generated with TLG data. The first was a semilemmatized concordance to Euripides' *Alcestes* (McDonald 1977); in the following years, McDonald also produced concordances to Euripides' *Cyclops* (1977), *Andromache* (1978), *Medea* (1978), *Heraclidae* (1979), *Hippolytus* (1979), *Hecuba* (1982), *Hercules furens* (1984), *Electra* (1985), and *Ion* (1985). These are not individually listed in the bibliography; see (McDonald 1977) for publisher and series information.

> Much of my time between '71 and '72 was spent trying to analyze what I needed to make a project this big "go." I needed a system that went beyond data entry, I needed a system that involved people, books, organizations, hardware, software, procedures. I needed a big package. The first person I hired ... was a systems analyst ... and it was with her that I put the package together that involved everything from silly things like tables and chairs to encoding conventions to hardware, to software, the procedures, the books, we addressed everything that the project conceivably might have to confront in the next decade or two decades. *And the package ended up being so good that it's still running almost the way it was set up then.* (Ted Brunner; emphasis mine)

What were some of the components of this "package," and how did they evolve?

5.3.1 Data Selection: Defining the Corpus

As indicated above, one of the most difficult parts of creating a database is selecting the texts to incorporate. Given the many editions available for some authors, and given the fact that not every classicist can be an expert on every author, who is to chose the versions for inclusion? How can one know that one has "the best"? This question is not new to the TLG. Consider the following comments made by Hermann Diels in the 1925 preface to the Liddell and Scott Greek–English Lexicon:

> ... Any one who bears in mind ... that for many important writers no critical edition whatever exists: and who considers the state of our collections and fragments and special Lexica, will see that at the present time all the bases upon which a Greek Thesaurus could be erected are lacking. (Liddell and Scott 1925)

From the very start, the TLG has not been involved in the selection of the source texts. Instead, this problem was turned over to the discipline as a whole, as represented by a committee of the American Philological Association (APA). Experts on particular authors, periods or genres are recruited to select the texts for inclusion in the databank. Of this phase of the project, Brunner says,

> The next thing we had to do is find the source text. In 1972, '73, nobody knew who had written what, when. ... We had to find the texts to each one of those authors. We suddenly realized that if we were to make unilateral decisions about those texts, sooner or later someone would shoot us down, ... There was a truly blue-ribbon panel created by the APA; even though it changed in make-up over the years, it is still composed of top-notch people.

The first TLG Newsletter (special edition 1973) includes a list of 49 authors to be converted into machine-readable form. The list was the culmination of a two day meeting of the APA

Advisory Committee to the TLG convened at that time at the Center for Hellenistic Studies at the University of California, Berkeley. For each author, a suggested edition is listed; sometimes different editions are suggested for different works of a single author.[6]

> People began to advise us on what editions of Homer to use, or of Plato. Once they had given us advice on a batch of texts, it was up to us to find the editions. In the case of Homer or Plato it's easy to find the best edition in the bookstore. But there were many, many authors which were out of print, of whom only one edition was cited somewhere. We went as far as Czechoslovakia and hand-carried texts back. (Ted Brunner)

This kind of searching and seeking out the needed editions is an on-going project. In mid-1989, Brunner and the TLG staff were still involved in tracking down text for data entry. He had recently had help from a former UCI graduate student, who had gone on to a faculty position at the University of Crete.

> A few weeks ago [the former graduate student] ran into an edition that was published around the late '50's which we needed for data entry. We turned this country upside down using interlibrary loan, we went to the British Library, the Library of Congress, to every major library in the United States. The book was not to be found. The next step is, since it was published in Greece, we go to Greece, and start calling people. People who you know, do me a favor, take a look in your library. I then faxed a letter to him saying I need this edition, see what you can do for me. He got to work and started making phone calls. He tracked down the heirs of the person who published that text, found a granddaughter and she had one copy of that text and it's now on its way express mail to UCI. Problems like them, it's incredible, zillions of problems that you have to deal with. (Ted Brunner)

As mentioned in the previous chapter, one of the TLG's significant contributions is the collection of all this literature in one single place. The *Thesaurus Linguae Graecae Canon of Greek Authors and Works* (Berkowitz and Squitier 1986) is of fundamental importance to a discipline whose corpus has been scattered and, in some cases, neglected for centuries. The *Canon*, as well as the TLG, are the physical embodiments of the very idea of a single Greek and Latin corpus of ancient authors. Indeed, one of the most successful components of the TLG "package" is that it involves the discipline as a whole as represented by the *American Philological Association* in the selection of the data to be incorporated into the database.

[6]For example, in the case of Homer, the edition of the Iliad to be used is that of T. W. Allen (Homer 1979), for the Odyssey, that of P. von der Muehll (Homer 1984) is recommended.

5.3.2 From Books to Bytes: Data Entry and Verification

Today, there is a well-established pattern for converting texts from book into electronic form. Some of the tasks have been automated, while others are exclusively manual; all require an advanced understanding of the Greek language and of classics. The TLG staff consists— and has consisted over the years— primarily of individuals with some training in classics and an interest in computing. At a minimum, this means a Bachelor's degree, though several staff members are working towards or have their Ph.D.s in classics. Some stay indefinitely, others move on after a few years. One staff member says of the job, "it's not the kind of occupation people train for." In preparing texts for data entry and reviewing and correcting the results, the steps taken are as follows:

1. A portion of the staff is involved in pre-editing the text. These are classicists who work with texts and who "look at the text from the scholar's point of view, what should go in and what shouldn't ...."

2. Next, the text gets passed on to the computer staff. "They look at the text from a computer person's point of view. A scholar tends not to notice a shift from one font to another; a computer type [person] recognizes that immediately." They spot potential data entry difficulties.

3. A staff member writes a cover letter for the data entry contractor explaining what is to be done. These letters are "extremely precise and complex."

4. The text is sent to the data entry contractor. About two months later, it comes back with a magnetic tape containing the text in electronic form.

5. The computer staff make an archive copy and apply a set of correction and verification programs, developed in-house, to catch both data entry errors and typographical errors that may have been in the source text.

This process, stretched over a period of several months, is how a text is transferred from book to electronic form. This process— another well-hidden component in the TLG "package" is one that few smaller tool-creating efforts can duplicate. It isn't worth developing such a stringent set of verification procedures for the entry of a single text, yet failure to provide accurate data dooms a project.

Other projects also include data verification, but use methods that simply would not work for databanks of the scope of the TLG. For instance, one component of an effort to develop a commentary on Piers Plowman, a 14th century medieval English alliterative poem, included the creation of a machine-readable version of the "B" version of the text. The method of data entry and verification was as follows: two graduate students and the departmental secretary typed in an edition of the text, each into their own IBM PC-compatible machine. One of the

graduate students then used a commercial software product to compare the entered versions, two by two, to spot discrepancies between different on-line text versions. If a discrepency were found, she would then check these versions against the text, the idea being that three people were unlikely to make the same typographical error, and so any such errors would be caught. Printers' errors would not be detected in this way, of course, unless the graduate student were to recognize a potential error in the edition during data entry (Medievalist).

Data entry. Entering a text three times and comparing typographical errors may work for a text of only about 71,000 words, but is prohibitive when applied to the entire corpus of Greek literature. Estimated at the start of the TLG project to consist of 90 milliion words, the Greek literary corpus would have been *over a thousand times larger* than the text of *Piers Plowman* entered in the medieval English project. When the TLG project was begun in the early 1970's, computing was done on mainframes, with data entered via punched tapes or paper cards. After timing an operator, they concluded that it would be infeasible to hire people for in-house entry. Samples of a text of Appolonius of Rhodes were sent out to contractors in Greece, Mexico, South Korea, and Singapore; Greece was quickly ruled out because the similarity of modern Greek to ancient Greek led to too many typing errors. Eventually, a data entry contractor in Seoul, South Korea, was selected; data entry has since moved to the Philipines.

Preparing the texts for entry involves making a photocopy of the original and crossing out spurious information— crossing out anything that shouldn't get entered onto the final tape. This includes title pages, introductions, notes, the apparatus criticus, and other elements that are not purely "the text." Again, this task must be carried out by individuals who have a sufficient understanding of classics to be able to make such judgments— and who have the requisite language skills, as many editions are not in English; they may be in another "living" language, such as French or Germany, or the preface and other supplementary materials may be written in Latin.

One might ask why the TLG does not use optical scanners. While this technology is improving and is potentially useful for large data entry projects, those working with Greek texts have found it to be troublesome. With manual data entry, for instance, the TLG records an error rate of about one in 25,000 characters. When data entry techniques were first being considered in the early 1970's, scanners had an average error rate vis-à-vis Greek text materials of one in ten characters for clean source texts, and about one in six if they were not in pristine condition. Similar problems were reported at a recent Computer User's Group meeting at the *Annual Meeting of the American Philological Association* (San Francisco, December 27–31, 1990). The quality of scanners has definitely not improved to the point where switching from manual data entry would be considered feasible. One classicist who used an optical scanner to read a series of inscriptions, the Delos *hieropoioi* (taken from the *Inscriptions de Delos* and the *Inscriptiones Graecae*), found that after spending 60 hours

scanning in the materials, "the final text was full of errors; it took a full year to proofread it" (Classicist).

These problems with the entry of Greek texts don't necessarily translate to other domains. For instance, the medievalists entering the *Piers Plowman* texts used a scanner to enter the "C" text, and found that, in the end, it was "not too much trouble." It took a couple of weeks to correct and edit the text; for instance, when scanning the letter combination "er" the "e" would sometimes be dropped. Also, the person responsible for the scanning had to "teach" the machine to recognize special medieval English characters. Though they could not be printed, the machine would substitute another character, such as a "3," for them, and then they could be replaced with the appropriate character using a word processor. At almost 75,000 words, the "C" version is longer than the "B" version by about 4,000 words. (Medievalist)

Verification and correction. Regardless of the care with which data entry might take place, the resulting electronic texts were prone to error, not only because of potential data entry errors, but because typographical errors might have existed in the edition used for data entry. So, the verification of the electronic text actually also involves verification of the edition on which it was based! Some errors are caught during the conversion from the form used by the data entry contractors to the special Beta code used by the TLG; problems with conversion generally signal errors in data entry.

Beyond this, the TLG has used two kinds of verification programs: the tri-graph approach and morphological analysis. Under the tri-graph approach, the program looks at groups of three consecutive letters of a word at a time, and rules out or approves of words on the basis of whether or not these letter combinations are possible. The problem with this approach is that there are too many "maybes," which then need to be looked up in a table (expensive to maintain if one is paying for disk space), or considered individually by a linguistically-skilled operator. The ratio of "maybes" to accepted or rejected byte combinations was about one thousand to one (Brunner 1989).

The change to a new approach was made when the change from the Sigma 7[7] mainframe computer to the Ibycus system took place (discussed in more detail below). The morphological approach is quite different from the tri-graph approach. Greek words follow very regular patterns of composition: stem, accents, endings, and so forth. Because of this regularity, it is possible to take parts of the word and run separate programs on them using a set of tables for endings, stems, augments, and other components. The three basic programs used for verification are:

[7]The Sigma 7 was a 32-bit mainframe originally built by a company called Scientific Data Systems (SDS). They sold it to Xerox Corporation, which sold it to Honeywell. It runs under the CP5 operating system (Tim Morbgan, Department of Information and Computer Sciences, University of California, Irvine; *personal communication*).

1. a program for morphological analysis, which tries to isolate morphological components, looking for endings, roots, augments indicating tense, etc.;

2. an accent program based on Greek rules for breathing marks, accents within a word, etc.;

3. and a punctuation program which checks for the conventionality of marks.[8]

This kind of approach is costly in terms of storage, as it relies heavily on tables. When the program encounters a problem, it stops and highlights the word in question. "There are several options. You then compare the screen with the printed text. If there is no match, then it's a data entry error. If they do match, you have to decide if the error is in the text or if you should let it go" (TLG staff member). Exceptions or special forms that might occur again can be added to a dictionary list.[9] In either case, the human operator is critical to the process in order to intervene when there are no mechanics for deciding on the validity of a word (rare or special forms, for instance). Needless to say, a fairly sophisticated understanding of Greek is essential on the part of the operator.

5.3.3 Computer Evolution and the TLG Package

The TLG is available in three formats: on tape, via a special-purpose stand-alone minicomputer called the Ibycus, and on a CD ROM[10] which can be accessed via a CD ROM reader connected to a personal computer (PC) and using appropriate software. I'll try to describe the different options not only in terms of their role in the history of the TLG, but in how they function as a part of a larger "package" of computing from a user's perspective.

Mainframes. When the TLG was first begun in the early 1970's, personal computers had not yet been developed. Those wishing to use a computer for some kind of task had to

[8]The earliest Greek scribes used neither accentuation marks nor punctuation nor did they necessarily provide word divisions; the addition of these aids to the reader was a slow process and, like everything else in classics, is under debate. The invention of the system of accentuation and improved methods of punctuation are both commonly ascribed to Aristophanes of Byzantium, head of the Alexandrian Library c. 195 B.C. The use of accentuation and punctuation was, however, haphazard; Reynolds and Wilson (1974) write "...in general it is hard to see what principle determines [accents'] addition in ancient books, and they were not regularly added until the beginning of the *tenth century*" (emphasis mine). For further information, they refer the reader to Turner (1971), Pfeiffer (1968), and Renehan (1969), among others.

[9]The dictionary is implemented as a *hash table*, a formal data structure treated extensively in many computer science texts; see, for example, section 4.3 in (Standish 1980).

[10]Just as a reminder for those who missed this in an ealier chapter, "CD ROM" stands for "Compact Disc Read Only Memory." It refers to an optical disk (like the compact disks replacing records and tapes these days) on which information is, at this point, permanently stored and retrieved via lasers.

turn to large mainframes. For the TLG staff, this meant turning to the UC Irvine campus computing facility:

> When we first began, when a tape came back from Korea, it ended up in the Computing Facility in the Sigma 7. It was the mainframe being run in the Computing Facility at that time. ... When we wrote our initial verification programs for the Sigma, we thought ahead to the day when a new machine would be there, which meant we had to use a programming language that had portability, transferability, that would lend itself to the kind of project we had. Initially, we opted for COBOL [a programming language better-suited to handling text-based data than other languages which were oriented towards handling numeric data].[11] (Ted Brunner)

In addition to verification and correction programs, the TLG developed a special code to represent all the various Greek letters and attendant diacritical marks [accents, breath marks]. At the time, no commercial software existed to display Greek characters. One early user says:

> As far as using their product, I might as well have been in Kansas. Say I had gone to a computer terminal and punched up what was on the mainframe. What I would have gotten is not a Greek text in a form that I could read in Greek. It would have been in a code, you know what I mean? I tell my students that Greek has 24 letters. A computer thinks that it has about 250 letters [because of the accents]. ... These early pioneers I talked to you about forced themselves to be able to read that code on a screen or a printout .... (Classicist)

The TLG continued develop and refine the necessary software, and to rely on the computing facility from the early '70 until around 1980 when the computing facility acquired its first VAX. Although the Sigma 7 was still around at that point, it was on its way out. At the same time, the cost of using the computing facility was getting to be too great:

> The problem was that the database had grown by 1980 to such a size that I was bleeding to death slowly paying bills to the computing facility. The database was so big that disc storage alone chewed up massive amounts of money a day. (Ted Brunner)

With annual computing bills at about $200,000, Brunner and staff decided that an alternative had to be developed.

How did this affect TLG "customers," university departments anxious to gain access to the databank? Although departments began acquiring TLG tapes as early as 1974, access of TLG materials on tape via a local mainframe was difficult and cumbersome. Remember

[11] FORTRAN, for instance, was a language commonly used at that time for numeric information processing tasks.

that the information on the tapes was stored in a special code used to represent the Greek alphabet including not only punctuation, but diacritical marks as well. The burden of developing software to use with the TLG tapes that would be compatible with local hardware fell entirely on the shoulders of the purchasing individual or institution.

> For the average classicist to get TLG tapes was almost overwhelming. What does he do— he takes it to the local computing facility and asks them to hang the tape for him. What comes out are straight ASCII characters. Then they realize that they need Greek character capabilities. Who develops it for them? Not the average computer consultant. So, it was a nuisance to work with tapes. (Ted Brunner)

Someone would have to write the code for doing the actual text searches and displaying and/or printing out the search results.

This did not prevent some institutions from acquiring the tapes and developing the software for using them. One such entrepreneur, a graduate student in classics (at a major East Coast university) at the time, remembers the effort.

> There you were with magnetic tapes, what are you going to do with them? We had access to a PDP 11[12] running UNIX ... and so I started [after] a couple years getting myself up to speed, doing a lot of the work myself. And it was done on the psych department computer. ... [The Department of Classics raised $35,000 for a storage unit.] They paid for time on the system .... The quid pro quo was that the people in psych would get some revenue, which they did, and some storage, and in return we got a fair amount of service from them and support for putting this thing together. At the time, major departments were spending more like sixty or seventy thousand dollars buying Ibycuses, so it was considered to be a bargain. (Classicist)

Once one department had developed software, word would get around: "I heard that [a department on the East Coast] was doing something on a mainframe computer, and that [a West Coast department] had gotten their programs and was doing the same thing ..." (Classicist). One or two enterprising individuals would then use that software to create locally accessible programs. This was generally a task left to the interested (and often computer-illiterate) parties, sometimes with minimal help from a computing staff, or an occasional Humanities computing consultant, the burden falling on the shoulders of the interested classicist: "[I've learned] enough that I have added extra data to the databank; I used some of the programs to make indices, things like that, and I've even written a few short scripts myself for functions that are useful that were not originally in the [software acquired from the other universities]" (Classicist). Some of the implications of this will be discussed in the next chapter in the section on developing new expertise.

[12]The PDP 11 is a 16-bit minicomputer developed by DEC Corporation. It was the biggest selling computer of the early 70's, and remained quite popular throughout the decade (Tim Morgan, Department of Information and Computer Sciences, University of California, Irvine; *personal communication*).

The Ibycus Minicomputer. In the early 1980's the TLG project made a decision to create their own hardware and software. This system, called *Ibycus*, was developed by David Packard.[13] The system relies heavily on Hewlitt-Packard software and the Hewlitt-Packard operating system (the system itself is based on an HP 1000[14]). The language used for it was developed by Packard specifically for this purpose (Tool Developer). The Ibycus hardware and software were developed especially to facilitate the use of classical Greek texts with its special character set and extra punctuation and diacritical marks. At that time, there was no commercial software/hardware on the market capable of displaying Greek fonts, printing Greek, and processing Greek texts; developing the necessary equipment was an important first step (Tool Developer). This was an ambitious endeavor:

> Making the decision to shift meant the loss of a year, of all the software we had developed .... That meant we had to start from square one and rewrite the software. (Ted Brunner)

"Starting from square one" included not only rewriting all the software and changing the approach used for verification and correction (discussed above in more detail), but also retraining staff. The autonomy, however, was worth it: "That was the smartest decision we ever made financially, and in terms of flexibility locally. Tied to an outside computing facility, you lack flexibility" (Ted Brunner). The original Ibycus, a mainframe with about a dozen terminals and a printer capable of printing Greek fonts, was donated to the project by David Packard (announced formally in the 1982 TLG Newsletter). This was one of two Ibycuses built; Packard had the other one for his own use, experimentation, and further development.

Note that this minicomputer was *not* for general distribution or sale, but only for in-house use. The new machine required, again, customized software written in a non-standard language. In the process of moving to the new machine, a new format for storing code on tape was developed, referred to as Beta Format or Beta Code. The old Sigma 7 code became the Alpha Code. At the same time, two text packages were created— a 2400' tape reel containing the majority of "main-line" classical authors and a 1200' tape reel containing Galen and Pseudo-Galen— using the new Beta Code format, though tapes in Alpha Code format were still available (TLG Newsletter 1982).[15] (Other authors were, of course, also available.) New authors continue to be released on tape, with text releases and prices

[13]Ibycus was a sixth century B.C. lyric poet; little survives of his work. According to legend Ibycus was attacked and killed by robbers. A flock of cranes was passing overhead and Ibycus exclaimed, "Those cranes will avenge me." One of the robber later in a town, seeing a flock of cranes, said to his companion, "There go the avengers of Ibycus." This was overheard and the murderers were brought to justice. Ibycus was also the name of developer David Packard's cat.

[14]The HP 1000 is a 16-bit minicomputer generally used for scientific purposes such as controlling experiments. It was not designed as a general purpose computer for time-sharing (Tim Morbgan, Department of Information and Computer Sciences, University of California, Irvine; *personal communication*).

[15]"Pseudo-Galen" refers to a body of writing whose works are either written in the manner of Galen, or have the name of Galen attached to them (spurious works), mostly the latter.

announce in the Newsletter. In July 1985, for instance, the works of the Greek philosopher Sextus Empiricus were to had for $30.47 (TLG Newsletter, July 1985).[16] The new Ibycus minicomputer also provided the TLG Project with an opportunity to test the machine out on the local user community, the members of the UC Classics department. The same user who commented above on the difficulty of reading encoded texts, said of the original Ibycus minicomputer.

> [At last we were at the point] where we got a minicomputer which did put the text on the screen so that any scholar could look at it and immediately understand it. And where terminals were hung around our own offices and anybody who knew how to write with two fingers could be taught how to use this thing effectively in about 20 minutes. (Classicist)

Thus, while it meant a tremendous retrenching effort for the project itself, the development of the Ibycus minicomputer was an important step in the eventual development of the Ibycus microcomputer for distribution within the classics community. Feedback from users at UCI could be incorporated into the next step, discussed below.

The Floppy Diskette Debate Before continuing on to the development of the Ibycus microcomputer, I would like to briefly mention the "floppy diskette" debate. A repeated subject of discussion in the TLG Newsletter series is the question of making available the TLG materials on floppy diskette. Brunner has the following comments about a floppy diskette version of the TLG:

> In the early 1980, rumors about micro computers started to fly around. IBM started talking about the PC, Jobs started talking about the Macintosh. By 1982, '83,[17] micros were available and even though micros did not make immediate inroads into the humanities, into classics, little by little people in the US anyway started to buy themselves IBM PC's or Macs, which meant that the TLG started getting hit with a new category of requests.... The micro held out a hope that it would be easier to work there than on a mainframe. By '82 PCs and Macs started to become available to classicists and people said, send us the TLG on floppy. Which was something that betrayed an incredible amount of innocence. Remember, the Mac was a 128K machine with a 400K floppy disc and to just get Aristotle, 1.2 million words of text [multiplied by] 7.5 bytes would have some taken something like thirty floppies. You cannot disseminate a databank as large as the TLG on floppy. They started screaming at us. I dragged my heels at that

[16]Sextus Empiricus was a second century A.D. Greek philosopher, and our chief source of information on the Sceptical school of philosophy. In a series of three books, he states the position of the Sceptics and attacks that of the Dogmatists. Is it from him that empiricists derive their tradition of skepticism with regards to dogma or "grand theorizing"? The latinization of his name is a tradition stemming from the middle ages.

[17]The Macintosh did not come out until 1984.

> time because we knew that something else would come out later, the Compact CD ROM. So we refused to disseminate on floppy waiting for the CD ROM. ... The first TLG CD ROM came out spring 1987, the first to contain literary text. (Ted Brunner)

The first mention of the floppy diskette question in the TLG newsletter takes place in December of 1984, at which point IBM PC compatible dissemination was under consideration (at least formally). In the following year, Brunner states unequivocally that "the multiplicity and (more often than not) incompatibility of personal computers now in use throughout the field are such as to render widely acceptable TLG text dissemination of floppy disk virtually impossible ..." (TLG Newsletter, July 1985). Six months later, the move to CD ROM technology was announced.

The CD ROM. The third and fourth incarnations of the TLG both manifest themselves through means of the new CD ROM technology. First, with the availability of this new storage medium, it became feasible to develop and market an Ibycus minicomputer. Priced at about $5,000, it was and is affordable not only to classics departments, but to individual classicists as well. One classicists referred to this event when talking about the availability and accessibility of the TLG materials for the average scholar.

> The next breakthrough occurred about three years ago when, with CD-ROMs and microcomputers, you could get something that any scholar could afford. Any scholar, any place in the world for an investment of maybe four or five thousand dollars could have one of these in his office. (Classicist)

The minicomputer includes not only the CD ROMs containing the texts, but also search software and a word processor that can be used for cutting and pasting search results into papers, class handouts, and so forth.

The CD ROMs containing the texts are also available without the Ibycus minicomputer. Individuals could then purchase CD ROM readers and hook these up to the standard Macintoshs, IBM PCs, or other personal computers they already owned. The first CD ROM version of the TLG became available in early 1987; its availability— as well as dissemination and pricing policies— were announced in the January Newsletter (TLG Newsletter, January 1987). Two rates were included, one for institutions (such as departments, libraries, and humanities computing facilities), and one for individuals (either members of academic departments or institutionally unattached scholars):

Licensing fees charged to institutions, per disk:

Initial registration fee (incl. first year licensing fee)	$200
Annual subscription fee:	$100
Optional one-time payment covering five years:	$500

Licensing fees charged to individuals, per disk:	
Initial registration fee (incl. first year licensing fee)	$120
Annual subscription fee:	$60
Optional one-time payment covering five years:	$300

These fees included a copy of the *Thesaurus Linguae Graecae Canon of Greek Authors and Works* (Berkowitz and Squitier 1986). As personal computers have become more popular and easily accessible, many departments and individuals have come to consider acquiring the TLG CD ROM and a CD ROM reader to be a sensible choice, especially since the CD ROM reader could be attached to PC's often already available for use by students, faculty and staff for word processing purposes.

Software for *searching*, however, was not available from the TLG. But as the popularity of the TLG grew, software for using it was developed and could be acquired, usually without cost, from more enterprising scholars (such as the SEARCHER program for use with IBM PC's developed at the University of California, Santa Barbara). The TLG project served as a clearinghouse for information about such software (TLG Newsletter, December 1988), though it did not produce any such software of its own. At one point, the dissemination of a new CD ROM (version "C"), which included not only texts but also an index and an electronic version of the Canon, caused some problem with access via available software. A pointed reminder in the subsequent Newsletter reasserted the TLG's position: "Software capability is beyond the control of the TLG, and concerns about it should be addressed to the source of the specific programs being employed" (TLG Newsletter, May 1988).

With the switch to the CD ROM technology, the project had to add new administrative mechanisms to handle licensing. (The TLG Newsletter, January 1987, refers to the "considerable expense" of CD ROM creation and dissemination.) Instead of selling the CD ROMs as they had the tapes, the IBYCUS project offered the CD ROM disks on an annual or five-year renewable subscription basis. Interestingly enough, the Project expressly forbade using the CD ROM in a networking arrangement:

> Neither institutions nor individuals are permitted to employ TLG CD ROMs within an environment providing multiple users with access to a single CD ROM via mechanical, electronic, or other similar means. (TLG Newsletter, January 1987)

According to a project staff member, there are two reasons for this restriction. First, the TLG is trying to keep close control over its databank materials to maintain the data's integrity. Secondly— and more importantly— there legal reasons for this restriction pertaining to copyright. According to this staff member, because the TLG contains copyrighted material, the project is required to limit access to "fair use," similar to restrictions on photocopying books or renting videotapes. "The legal minds at UC [University of California]" drew up the

contract, and the TLG, as well as its "customers," is required to abide by the requirements set down by the university to limit liability.[18]

Despite these restrictions, the new CD technology was so much easier to manipulate than tapes that they did not hinder the rapid diffusion of the CD ROMs among classicists.

> ...the development of the Compact Disk was an absolute godsend because text dissemination on magnetic tape was a total nightmare. To verify and correct takes seventeen to twenty-four reels, people have to load those reels, keep track of them, whereas the CD ROM I can slip into a little envelope and keep track of it. (Ted Brunner)

Several project staff members echoed those sentiments. By mid-1989, 371 TLG compact disks were in circulation, and CD ROM licensees represented 23 countries worldwide. One particularly important feature of the CD ROM technology is that other database sites which had worked closely with the TLG began to disseminate their own discs, making additional texts available to those with TLG CD ROMs and the attendant hardware and software. These include the Packard Humanities Institute's Latin texts, texts prepared by the Duke Data Bank of Documentary Papyri and, in the near future, Greek inscriptions prepared at the University of Michigan. It also created a base of experience upon which other projects could draw in the future. For instance, the *L'Annee Philologique* may soon appear on CD ROM, as may the Munich-based *Thesaurus Linguae Latinae.*

Finally, by being accessible via standard personal computers, the TLG has become a component of a larger "package": a sort of "personal workstation" (Ruhleder and King 1991). Results of searches can be stored on floppy diskettes, just as excerpts of Greek texts can be directly incorporated into a manuscript. By becoming integrated into this larger package the TLG unwittingly has come support an even wider range of scholarly activities.

Original/Alternative means of access. There are two other ways in which access to the TLG databank has been made available to classicists: in person or by making a request of the TLG staff. Before 1987 and the introduction of the CD ROM disk and the Ibycus microcomputer, these were the only means of access unless one were willing to purchase tapes and write one's software for use on a local mainframe.

Some who wished to use the TLG traveled to UC Irvine to access it directly, much as the medieval scholars traveled to monasteries to use the collections in their libaries. For

[18]If you are confused by this, don't despair; so are many others. In fact, the copyright issues raised by a variety of new computer technologies are worthy of a dissertation in themselves. Interested individuals should start by browsing the periodically appearing column, "Legally Speaking," in the *Communications of the ACM*, the journal of the *Association for Computing Machinery.* I'm not trying to be facetious here— it's a really touchy issue and it sounds like the UC law team is trying to play it safe (cf. Lawrence and Timberg 1989).

instance, a doctoral student spent two months at UC Irvine pursuing dissertation-related research on the TLG premises in late 1987 (TLG Newsletter, December 1987). At some point, off-site access to the TLG data bank via telephone was considered (TLG Newsletter 1984). It was considered infeasible due to a lack of computer system ports and the lack of funding to purchase additional hardware or to create a scheduling arrangement allocating certain ports to off-site users during non-working hours. It is unclear why this was never pursued further, though one reason may well be that few users in the classics community are well-versed enough in electronic mail to make it worth the effort when time and money could be spent on activities more beneficial to a larger segment of the community. More common is the case in which scholars telephone or, especially, write to the TLG project with a search request. The manner in which the latter access is handled has changed over the years. At first, this was "slipped in" between other Project duties: "...the TLG will make every effort to respond to reasonable requests for text searches, provided that the nature and/or magnitude of such searches does not exert a negative effect on the project's [other activities]" (TLG Newsletter 1982).

Around the mid 1980's, there was a vast increase in search requests. At this point, these services were still being provided free of charge (TLG Newsletter 1984). This service soon overwhelmed the resources of the project, both in terms of time and money:

> During 1986, the project provided text search services for nearly 100 individuals. Although these searches consumed several hundred hours of staff time, thousands of pages of printout paper and other supplies, xeroxing (for the production of documentation), postage, and other miscellaneous expenses, most of the search services provided by the TLG during 1986 were provided free of charge .... (TLG Newsletter 1986)

Effective January 1, 1987, the volume of requests had become such that a search fee ($10), printing fee ($0.10 per page), and documentation fee ($0.10 per page) were instituted (TLG Newsletter, January 1987). In May of 1988, with lengthy explanation and profuse regrets, the TLG raised these fees to $35 per search and $0.20 per page of printout or documentation in response to searches over a period of six months that "consumed approximately 1,200 hours of computer time and close to 300 hours of personnel time" (TLG Newsletter, May 1988). Furthermore, conducting searches was limited to "time periods when they cannot cause system slow-downs affecting normal project operations"— in short, spare time or off-hours (TLG Newsletter, May 1988). A request for patience due to backlog is found again later that year (TLG Newsletter, December 1988).

And what is the scholar's point of view on search requests? Several have mentioned that they have "called up Ted" for the answer of a question, or written to the TLG, always with positive results. One, however, made the following observation, more a comment on the little ironies of university funding mechanisms than on the TLG: "I checked [a reference] in Liddell and Scott and in Stephanus' *Thesaurus* .... Knowing, however, that anyone with an Ibycus could find more information in a minute, I sent away to Irvine and asked the TLG

to search the literature for me. (It was, you may not be surprised to hear, much harder to get the $25 for that search than it would have been to get the $4,000 to buy an Ibycus" (Classicist). Their reply was timely, and confirmed a hypothesis he had proposed.[19]

Had this volume of interest surfaced in the 1970's, when the only available form of the TLG was on magnetic tape, the project might have felt compelled to add staff to handle search requests. By 1988, however, the TLG CD ROM was readily available and personal computers were becoming the norm within the scholarly community (most informants and their departments began purchasing personal computers such as the Macintosh, IBM PC, or IBM clones around 1986 or 1987). Thus, it was no longer unreasonable to expect individuals or departments interested in obtaining the information provided by the TLG to purchase the necessary hardware and lease the CD ROM disk.

5.3.4 TLG Project Decisions and the User Community

The TLG serves a user community composed primarily of classicists, though the TLG is also of interest to and used by philosophers, biblical scholars, medieval and renaissance scholars, and others. Who contributes to defining the project goals and directions? The original project description envisioned enlisting "the cooperation of scholars on a national and international scale" (TLG Newsletter, special edition 1973). Formally, the discipline is represented by a committee on the TLG composed of members of the American Philological Association, and guided by a governing board. In 1985, the TLG also sent out a user survey to solicit reactions and wishes from the user community.

Individuals may voice their opinions via personal communication. Their comments may concern the directions of the project as a whole (such as requests for dissemination of the TLG on floppy diskette), but many of them are of a more "scholarly" nature. The TLG staff record both known points of scholarly debate, as well as additional comments by individuals, in a special project data base.

> For instance, Plutarch: one of his works is considered spurious by some. Is it? There is disagreement, so this is noted in the comment field. Same with a label assignment [specifying the literary genre of the text]. If people disagree about what the label(s) for a particular work should be, this can be noted. The comment fields keep track of who thinks what about it, they keep a record of [the correspondence]. (TLG Project Staff Member)
>
> There are problems when a scholar who doesn't understand about a particular area or field of classics raises question, ie., asking if a particular edition is any

[19]He continues, "if you are surprised, please read 'High Finance or the Point of Vanishing Interest' in *Parkinson's Law* by C. Northcote Parkenson for an explanation."

> good. There are ways of raising issues and questions, though, and they [the TLG staff] can back up choices with correspondence, APA recommendations, etc. (TLG Project Staff Member)

In the end, scholars will "vote with their feet," and their feet have a greater tendency to walk *towards* the TLG than away from it, no matter how great their quibbles with the project goals or policies.

5.3.5 Inclusion of an *apparatus criticus*

One of the most often heard criticisms of the TLG is the lack of an *apparatus criticus*, or set of textual notes accompanying the body of the text (discussed in more detail in the next chapter). The TLG as originally envisioned was not planned to include the apparatus to the text, though its potential (or eventual) addition was a point of discussion at various times in the project. In the June 1982 issue of the TLG Newsletter, Brunner reports that at the September 1981 meeting of the APA committee on the TLG, "the committee endorsed the essence of the TLG's data entry direction [to enter only the basic text without accompanying critical materials], but recommended against addition of *apparatus criticus* materials and of "generic fragments" to the TLG databank (TLG Newsletter 1982). No justification or explanation is given.

User interest in apparatus materials surfaces again in the July 1985 newsletter, where the results of a TLG user survey are reported.

> Asked which materials, not currently falling within the purview of TLG data entry, should be added to the TLG data bank, the respondents suggested the following (listed in order of priority): 1. *apparatus criticus* materials; 2. generic collections; 3. scholia; 4. post-AD. 600 texts. (TLG Newsletter, July 1985)

By the summer of 1986, not only had users become more insistent on the need for apparatus materials, but the APA committee had reversed its position.

> A number of quarters (among them the APA's Committee on the TLG) have been urging the project to consider adding *apparatus criticus* materials to the texts now residing in the TLG data bank. Experimental *app. crit.* data entry is now under way via data entry of the *apparatus* in Kaibel's edition of Athenaeus. The project intends to expand its focus upon *app. crit.* data entry during the latter half of 1986. (TLG Newsletter 1986)

The inclusion of an apparatus criticus, however, remains a minor focus of project activities.

5.3.6 TLG Mysticism

> O! he sits high in all the people's hearts:
> And that which would appear offense in us,
> His countenance, like richest alchemy,
> Will change to virtue and to worthiness.
>
> — William Shakespeare, *Julius Caesar*, I, iii, 157

Finally, it behooves us to consider one other aspect of the TLG: the atmosphere it (and, I may add, other such projects) tries to create around its mission and its operation. The rhetoric surrounding the project is almost magical or mystical in nature. Words such "previously impossible" and "revolutionary" tend to crop up frequently. Consider the following excerpts from a TLG Newsletters, the other from a keynote address by Dr. Brunner, respectively:

> ... TLG text format is being revised to reflect the unique capabilities of the Ibycus System; and hardware ownership has begun to enable the TLG to provide user services previously impossible. (TLG Newsletter 1982)

> Suddenly, a Thesaurus, a "treasure" comprising some 1,400 years of ancient Greek literary activity could be acquired for less money than one would spend, nowadays, on a small handful of books. Not only that, but the *medium* which this amount of money would buy would open previously unimagined opportunities for research and scholarship. (Brunner 1989)

Now, while it may be argued that few scholars will understand highly technical jargon, it would be simple to say something along the lines of, "the new Ibycus machine is especially designed to handle the following problems with Greek text," perhaps mentioning that conventional displays or standard software are not designed for a special alphabet with accents and breath marks. As for the "previously impossible" services, it certainly became easier— and far less costly— for the TLG to handle search requests. Such use of hyperbole within a primarily computer-illiterate community heightens the sense expectation and awe surrounding the TLG (though, admittedly, it may be highly effective in obtaining funding, especially if one applies for grants within an equally computer-illiterate funding community). Of course, the TLG has the advantage of providing services to a community of people who have little experience with computers, and often an even smaller amount of inclination to learn about them. As the old saying goes, "In the valley of the blind, the one-eyed man is king."

5.4 Summary

This chapter contained a more detailed description of the development of the *Thesaurus Linguae Graecae*, a databank of Greek literary texts. It told not only about the history of this specific project, but also described its relationship to other tool development projects within classics, both past and present. The chapter included information about the technical, social, and organizational arrangements of the TLG projects, including arrangements for selecting texts for data entry, preparing and electronically encoding texts, and disseminating these electronic versions within the scholarly community. I used the package metaphor outlined in the previous chapter as a mechanism for explaining the success of the TLG despite its many problems and shortcomings.

Chapter 6

New Media and New Expertise

> Between the amateur and the professional ...there is a difference not only in degree but in kind. The skillful man is, whithin the function of his skill, a different integration, a different nervous and muscular and psychological organization. ...[He] is an automatism but he is also criticism and wisdom.
>
> — Bernard De Voto, *Across the Wide Missouri*

This chapter discusses changes in the work process that are effected through increased use of information technologies. First, however, I examine the potential for change via the introduction of new media by examining the impact that other types of innovative media have had in the past. In particular, I examine the impact of the printing press on classics. I then consider the kinds of activities scholars carry out and the tools they use in doing their work. The artifacts they use in their work both embody assumptions about and activities essential to the work process. These artifacts are reconstructed as they are transferred to new media, and these changes are reflected in the work process. New information technologies also effect the creation of scholarly products in the form of articles and books, and introduce new divisions of labor between scholars and publishers. And finally, new technologies require both individual scholars and the scholarly community as a whole to develop new forms of expertise.

6.1 New Media as a Catalyst for Change

> If men learn this, it will implant forgetfulness in their souls: they will cease to exercise memory because they rely on that which is written, calling things to remembrance no longer from within themselves, but by means of external marks; what you have discovered is a recipe not for memory, but for reminder. (Thamus, the king of Egypt's rebuke to the god who invented writing; according to Socrates as quoted by Plato in *Phaedrus*, 274–5.)

New media have long provided novel opportunities for the creation, manipulation, and transmission of information. Lyman (1984) paraphrases Marx and Engels thus: "A technology

gives threefold shape to work: it gives form to the everyday experience of work; it defines the concepts with which we think about experience; and it imposes control upon the social relations of work." Indeed, new media have served as a catalyst for change in the nature or process of various domains of work, and as catalyst for the transformation of cultural values and arrangements. Similarly, the combination of skills required to produce and use the artifacts associated with a given medium shape and define their integration within a given culture (Clanchy 1979:88). The development of stable writing materials coupled with the spread of literacy, for instance, led to the decline of oral culture as the written word eclipsed the spoken (Ong 1982). The introduction of the codex (or book) format and of parchment in the late Roman empire can be considered as revolutionary in its day and age as the later invention of the printing press, and the spread of literacy was certainly coupled with the development of an apparatus for the production and use of written records involving everything from the increasing use of seals to the development of cursive script for quicker transcription (Clanchy 1979).

New technologies may support particular kinds of experience and shape ways of thinking. The phonetic alphabet, for instance, leads to a sharp division in experience between auditory and visual experience, and supports lineal sequences as forms of psychic and social organization, not associated with the hieroglyph or ideogram (McLuhan 1964). With the advent of the printing press, reference works with novel layouts forced readers to reorganize their thinking and apply new cognitive skills (Eisenstein 1979); for instance, the proliferation of printed reference works encouraged a repeated recourse to alphabetical order, and since the sixteenth century the memorization of a fixed sequence of discrete letters has been a cornerstone of every child's education (Eisenstein 1983). Research into the development and dissemination of a variety of new media, including not only the printing press (Eisenstein 1979, McLuhan 1962), but also the ability to create "exactly repeatable pictorial statements" (Ivins 1953) and to mechanically reproduce art (Benjamin 1968) leads to the conclusion that new media can profoundly alter the way that people incorporate various forms of information into their work.

According to Baker and others (1977), computers have made a great impact on the nature of scientific research: "[i]dea generation, the crux of the creative process (...), is influenced in fundamental ways, such as the kinds of ideas, what they are about, the terms in which they are conceived, and the stimuli to which they are a response." Again, specific technologies are seen as having certain attributes or supporting certain forms of cognition. The microcomputer is seen as offering tools for both qualitative and quantitative analysis that will more easily allow researchers to integrate these analytic approaches (Ragin and Becker 1989). Commentators on hypertext suggest that it is compatible with a more relational way of thinking belonging to a technical culture, where text is read for information, as opposed to the linear ways of thinking encouraged by books, which belong to a narrative culture (Lyman 1989). The Harvard *Perseus Project* seeks to directly exploit the possibilities for relational thinking: writes one reviewer of the project, "*Perseus* texts and images will be linked in ways that facilitate and invite active and interactive learning," and considers the

cross-referenced nature of the *Perseus* materials (located in a variety of data bases) to be one of the project's "major contributions to learning and research" (Hughes 1986).

One kind of advance supplied by various new media is the ability to quickly and accurately repeat or reproduce some form of information. Just as Eisenstein (1983) hails printing as a prerequisite for early modern scholarship and science, Ivins (1953) posits that the ability to provide "exactly repeatable pictorial statements" was the key to advancement in scientific enterprises. Latour (1986) extends this discussion through his concept of "immutable mobiles" by demonstrating the immense advantages gained by working with two-dimension, reproducible, transportable inscriptions. These advantages were not confined to the sciences; consider the dramatic advantages available to travelers and navigators once maps could be accurately reproduced (Eisenstein 1979).

But reproducibility also leads to the question of what information is "valid" or "valuable," and what kinds of information are not reproducible. Consider the ability to mechanically reproduce art:

> Even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be. ... The situations into which the product of mechanical reproduction can be brought may not touch the actual work of art, yet the quality of its presence is always depreciated. ... One might subsume the eliminated element in the term "aura" and go on to say: that which withers in the age of mechanical reproduction is the aura of the work of art. (Benjamin 1968:220–221).

A less dramatic of phrasing the loss of quality or content from a different venue can be taking from research into tools for computer supported cooperative work, where Bly and Minneman's work on the use of drawing in engineering design concludes that the *shared act of creation* is as important as the resulting drawings themselves (Bly 1988, Bly and Minneman 1990).

The printing press is one medium which has certainly had a great impact not only on classical scholarship, but on all disciplines. Certainly the printing press made possible a wider dissemination of texts; it was no longer necessary to travel to a particular monastery or library in order to gain access to a given text. It allowed easier access to certain kinds of information that would previously have been limited to a certain set or class of individuals. Errors were also more widely disseminated as a result (as opposed to the unique errors inherent in manuscripts copied by individual scribes), but could be also be corrected on a mass scale *via* printed errata (Eisenstein 1979). The errata page included with a book published by the Oxford Press during the reign of Elizabeth I also highlights the difficulties of printers in the days before typewriters and rapid communications, and lists the "absence of the authour, the hardnes and smalnes of the hand[writing], wherein the copy was offered to the presse, and the vnacquaintance of the ouerseers with the same" as at fault (Bodleian 1978).

A new proliferation of "self-help" books accompanied the spread of a print culture: while medieval scribes had already turned out everything from manuals for inquisitors to advice on dying in one's bed, "there is simply no equivalent in scribal culture for the 'avalanche' of 'how-to' books which poured off the new presses, explaining by 'easy steps' just how to master diverse skills . . . " (Eisenstein 1979:87–88). More importantly, Eisenstein also suggests that the ability to produce and reproduce reference works on a large scale, and the ease with which new printing layouts could be tried out, forced readers to reorganize their thinking and to apply new cognitive skills. The "ardor for system" already prevalent in the middle ages now could flourish by means of a medium that allows the easy reproduction of concordances, calendrical computations, and astrological and alchemical treatises (Eisenstein 1979:97).

The development of the printing press had profound effects not only on the readers. With its development also came a whole new infrastructure supported by a new breed of individuals: printers, apprentices, publishers, editors, and so forth. Without the emergence of this infrastructure, the impact of the printing press would have been negligible. We shall see later that, as the transition from the monestary to printing requires the development of a new form of infrastructure, so does the transition from printing to computing.

One important issue is *trust*: how accurate is the information obtained via a particular medium? Consider the transition from an oral to a written culture: "Documents did not immediately inspire trust. As with other innovations in technology, there was a long and complex period of evolution .... People had to be persuaded ... that documentary proof was a sufficient improvement on existing methods to merit the extra expense and mastery of novel techniques which it demanded." Of course, as a medium gains familiarity, things can swing the other way, and "[a] modern literate tends to assume that statements in writing, especially if they are in print, are more reliable than spoken words" (Clanchy 1979:231). The printing press neither is nor was exempt from the danger of such potentially misplaced trust. Keep in mind the very fragmentary and incomplete nature of classical texts and the potential effect of printed editions. Indeed, Reynolds and Wilson (1974) write, "the early printers, by the act of putting a text into print, tended to give that form of the text an authority and a permanence which in fact it rarely deserved." This sentiment is echoed by other scholars. Youtie (1974), a papyrologist, writes that published transcriptions often "take on an appearance of lucidity and correctness which is as astonishing as it is deceptive," the final version omitting all traces of hesitation or self-doubt on the part of the transcriber. For most scholars, not the papyrus but the transcription becomes the source material for historical and linguistic research.

Does this danger of mistaken trust carry over to computing? One might cite as an example of skepticism the prevalent joke/sign, "to err is human, to really foul things up takes a computer." Classicists, however, do worry about the consequences of using computer-based textual materials. Ted Brunner, director of the *Thesaurus Linguae Graecae* project, sees the computer as "...a far more dangerous instrument than the printing press. The printing press *stabilized* our texts by removing the pitfalls inherent in manual text copying .... The

computer, on the other hand, renders modification of electronic text holdings almost child's play [subjecting data banks to potential contamination]." In fact, the malleability of the medium and new opportunities via hypertext may call into question traditional notions of publishing and authorship (Blank and others 1989; Classicist).

On the other hand, subdisciplines within classics such as classical archaeology and classical art history which require access to the object of study (such as a vase or statue) may benefit from computer generated, repeatable, two- or three-dimensional statements. High-resolution computer graphics capabilities will eventually make it possible to view coins, papyri, or temple inscriptions in the privacy of one's own office— perhaps even to call up a holographic image of a statue. Currently, it is necessary for the researcher to rely on photographs coupled with written or verbal descriptions of the object, or to travel to the location of the object itself. These possibilities have captured the imagination of classicists wishing to be freed from current constraints (Classicist). As mentioned earlier, the *Perseus* project at Harvard is trying to incorporate multi-media into a tool for classicist to support both research and teaching. Computer-aided design (CAD) tools are currently begin used in areas such as archaeology. One archaeologist specializing in Greek architecture writes:

> My scholarly work ...has traditionally involved scaled drawings as both the method of organizing data and the method of presentation. This has, in turn, meant that the presentation and understanding is two-dimensional to a great extent, and much depends upon the ability of the scholar and his audience to visualize three-dimensional reality from two-dimensional information.
>
> Beginning in 1985 I started to apply computer-assisted drafting and design tools to my work. ...I quickly changed to three-dimensional programs and have been using them since 1987. ...I can maintain far more information in more flexible forms through the use of [a computer-aided design system's] layering features, and I can easily and quickly try many more possible reconstructions .... (Classical Archaeologist)

One problem, and this, of course, is similar in nature to the problems of representing incomplete or questionable textual data, is that of handling imprecision in graphical data bases. Eiteljorg (1989) writes, "For instance, the description of a figure on a vase should not be ambiguous in the data base, but the figure itself may be, and expressing the ambiguity which there is can be very difficult. Furthermore, there is always the possibility (probability) that one scholar may see it differently from another.

6.2 Artifacts as Packages

In this section, I want to discuss in some detail two kinds of artifacts I mentioned in an earlier chapter: *textual editions* and *tools for searching.* These artifacts can be described as "packages," as they embody expectations about the work process, the expertise needed to carry out work, the values of those who use them, and an infrastructure necessary to create and maintain them. I want to first break them apart into their various components, then consider the changes to these "packages" that have resulted from the introduction of information technologies into the discipline.

In doing so, let us recall the concept of *immutable mobiles* mentioned above, and consider also the mutability of those mobiles by means of local instantiation (Latour 1986, 1987). Both textual editions and search tools serve as examples of "reproducible, transportable inscriptions" which must be instantiated in particular work settings in order to be used by the people in those settings. Their mutability emerges via what Star (1989) refers to as the central tension "between representations, which are static and abstract, and work, which is real-time and concrete." Textual editions, as will be discussed in more details below, are essentially representations of information about a text, including its history and its reliability as a witness to the archtype. The *interpretations* of texts are examples of their local instantiations; their interpretation over time can be termed their "re-representation path" (Star 1989). The mechanisms by which this happens are elaborated upon below.

First, we return to the description of one classicists' work activities used in a previous chapter, and add some of his reflections on the transition from traditional tools to the electronic databank, the TLG. Again, these comments pertain to the classicist's work on a book on allusion in early Greek tragic poetry.

> You see, there's no obvious or immediate way to go about identifying allusions. And, so, I began the way it always used to be; I read my text carefully and, whenever it rang a bell in my head and I thought I remembered a passage it alluded to, I would check it out. Fair enough, that word or those words or phrase might be in that other passage. But then you have to make sure, just because it's there in that passage, is it really an allusion to that passage? Where else might that word or words be? And there comes the rub. Then would then entail just for the author, say Homer, taking the index or concordance to Homer, and checking how many occurrences of that word or phrase there are. If you find that it's unique in Homer then that's good enough.
>
> But then you need to check other places, so then you check, is it a rare word? You can start out with a dictionary. Sometimes that will indicate to you; but then, basically, you have to go to individual indexes and concordances for each author, and just see where all it's used, how it's used, if it's used very often. And it may be, when you're doing that kind of work, that you just might have a hunch, "I don't know for sure, this looks like a fairy unusual word to me in this passage, maybe this is an allusion." You start looking at it, first it looks good. But maybe you spend half a day, one of

> your good mornings when the working hours are great and you're bright-eyed, going through it, ruling out author by author and thinking you've been through it, and then all of a sudden you hit two authors and you find it's very, very common and it occurs all over the place, and it couldn't work as an allusion. It's a very laborious process that way. And one of the things that does to your work, because each search takes you so long, involves using so many books, so many concordances and indices, piecing them all together, you have to think of ways to be cost-effective. Your time is valuable and limited. You can only play out a certain number of your hunches, go with the best ones.
>
> Now, once the Ibycus came along, ... [f]or instance, say I'm reading along in Euripides and I see a word and I say, "you know, this seems to me a really rare word, and I think I remember it's used once in the Odyssey, and maybe it's an allusion to that passage," put up an all-Greek search on the screen, type in that word, tell the machine to search through, and then just turn my back and go about my work and 40 minutes later I look, the machine has a match for me. It will have that match from the Odyssey and if there are any others, they'll be there. And if there are no others, it will tell me there are no others. And, with only the amount of time it took me to type in the word and set the machine going, I'll have the answer. [Constructed from an interview with a Classicist]

This excerpt, of course, deals only with part of the larger process of writing a book. It does, however, make extensive use of the two "packages" I mentioned above, textual edition and search tools. The *texts* serve as a basis for work, and various *tools* are used for locating particular kinds of information within those text. Below I will discuss in greater detail their various components. I will examine the kinds of information they provide, how that information is arranged, what tasks are embedded and which are not, and what the ramifications of a transference to a new medium might be for the nature and process of work.

Re-presentation of Text

The text is a key source of both inspiration and data not only for literary critics, but for all sub-areas within classics. Textual evidence is an important source of discovery about Greek and Roman civilization and an equally important source of support for evidence gathered by other means, from archaeological digs or works of art. But to talk about "the text" is deceptive; any scholar working with Greek and Roman writings knows there is no such thing as a definitive text.

In an earlier section, I discussed the fragmentary and questionable nature of texts dating back to antiquity. In some cases, only copies of other copies exist, dating back to the Middle Ages, perhaps, and subject to scribal error and emendation. Certainly the restoration of these texts as close as possible to the original is an important primary activity within classical scholarship. By the time a particular work appears on-line or in book form, the editor has

made a series of *decisions* about variant readings, or the inclusion or exclusion of certain sections of text. Sometimes, authors might have even written multiple versions of a text over the course of their work-lives. These kinds of problems and considerations are not limited to classicists, of course, but affect any who are working with similarly fragmentary or questionable data originating in the era of the printing press. Consider the following comments of two medieval English scholars involved in a commentary project.

> [The medieval English text we're working with] exists in 50 manuscripts. There are three basic versions. It's getting to the point of having some definitive text of each version. As [a colleague] says, you have to decide at some point, you have to lie, you can't know what was in the person's mind while writing. With certain editorial methods, you come up with what you think existed before scribal error. (English Medievalist)

> Any argument based on a reading of the text, people are going to argue about it. We are doing a commentary on the best edition [of a medieval English author] available, not on the exact text. This version has a full apparatus criticus available. The edition is very controversial. It's the best edition, but not everyone agrees on the methods used to construct it. (English Medievalist)

These comments exemplify both the frustrations and the compromises that are part of the editorial process, and the on-going and fluid nature of the collaborative academic efforts surrounding this process.

Because of the nature of the textual evidence, that which we call *the text* already embodies out of necessity a series of value judgments on the part of the editor or commentator. The difference between various presentations of the text lies in how *implicitly or explicitly* these decisions are represented in the text "package," which kinds of critical materials are *physically coupled.* Different choices for the "package" will have ramifications for the work of classicists both in terms of problem choice and work strategies.

Various formats for presenting text deal with the fragmentary and disputable nature of classical texts in different ways. One of the simplest ways is used heavily by papyrologists, whose data is quite often literally fragmentary: torn, smudged, written in difficult-to-read handwriting subject to scribal ideosyncracies. For example, dots are used to indicate area of the papyrus with holes or tears where the editor presumes the existence of a letter in the original. Markers such as these can apply to single letters or whole sections of text. Their use is quite old; signs to denote spurious verses, for instance, were already used by Zenodotus in the third century B.C. (Reynolds and Wilson 1974).

The drawback with this system is that a simple mark such as a dot or other symbol convey to the reader no understanding of scholar's reasons for placing a sign at that particular point. Various means for providing this commentary have been employed, such as providing a separate text with explanations. Once vellum and the *codex* became the standard, medieval

scholars added their commentaries in the margins of the books; these commentaries are referred to as *scholia*, and there exist modern editions of the scholia alone.[1] Scholia were unique to a given manuscript, just as each manuscript was a fairly unique "edition" of a text.

Today, most scholars turn to books when working with a given text. I would like now to consider the printed book, and to examine here the connection between the *body of the text itself* and various kinds of *critical and explanatory notes* that may explain the ways in which decisions about the text were made or list other editors' decisions about the same word or passage. The traditional text in book form contains more than the body of the text itself.[2] Of course, the text is the best "guess" or approximation of the editor of that particular edition. How this guess was made and how it compares to others' guesses is an important part of the supplementary material to the text.

A textual edition will include, first of all, an introduction in which the editor may explain methods or criteria used in reaching decisions about the editorial process. In his edition of the poems and fragments of Bacchylides, a Greek lyric poet born in the fifth century B.C., Sir Richard Jebb provides the following information in the *general introduction*:

- A description the life of Bacchylides,
- his place in the history of Greek lyric poetry, his characteristics as a poet (including a discussion of dialect, grammar and meters),
- information about the papyrus (including autotype plates, notes about the habits of the different scribes as determined by the evidence of different hands in the transcriptions, and six pages of notes on signs used in the papyrus),
- and, finally, the text of the papyrus itself "as it stands when the smaller fragments, which had become detached from the continuous portions of the papyrus, have been fitted into their places" (Bacchylides 1967).

This is then followed up with introductions to the odes, a translation of the text with notes, the fragments of Bacchylides and notices of his poems found in other ancient writers, an

[1]The *scholia* play a doubly important role in classics: not only do they provide us with an understanding of scholarship in that age, but often they include references to other works known at that time, but now lost to us. A brief quotation of a no longer extant work may be its authors only voice left today.

[2]In her introduction to the study of English Literature, aimed at the undergraduate, Marjorie Boulton (1980) writes, "True scholarly editing, aimed at the reader at undergraduate level or above, involves at least one of three possible functions: to provide a carefully considered *text*, so that the reader is given, as nearly as possible, what the writer intended; to add to the text some helpful *background material*, such as a biographical sketch, a placing of the work in its context in general history and the history of literature, an exposition of particular literary traditions (or innovation) and techniques involved, and explanation of the textual history and problems; a general critical appraisal: and to provide *explanations* of the more perplexing points in the text, by means of *annotations*— footnotes, marginal notes, or notes at the back of the book— or perhaps a more general glossary." She also notes that not all editions are designed for "scholarly use," and may omit some information or forms that would not be of interest or use to an undergraduate reader. Needless to say, these are not the editions I consider in this dissertation.

appendix on the "probable compass and contents of Ode I, when entire," and a "vocabulary" section which serves as a concordance, and an index of terms and names. While this particular edition may be especially rich in supplementary material, this is not an uncommon example of the aids to the reader supplied by the traditional textual edition. An 1850 edition of the Aeneid of Virgil, for example, promises a text complete with "English Notes, Critical and Explanatory, A Metrical Clavis, and an Historical, Geographical, and Mythological Index" (Virgil 1850).

One more comment, this one about a special component of such notes— and an exceptionally vital one— called the *apparatus criticus*. This set of textual notes, placed at the bottom of the page, lists variant readings in all or or at least the major alternate manuscripts or editions. The apparatus forms a collection of critical observations by different commentators on the text, tracing the history and logic of editorial decisions. This is vital in a field where the family tree or "textual tradition" of an author's work forms a major component of information about that work. Indeed, an apparatus is a very complex intellectual tool, as the following slightly abridged interview excerpt will show.

> Creating an apparatus is a very labor-intensive and intelligence-intensive process if you want to do a good job at it. Because of the way the apparatus is written in relation to the text that's above it, it takes some intelligence to decide what to put in your version. If editor A puts a particular word into the text, then what he puts in the apparatus may be the very word that is already in [the text of] editor B. And for some authors there's so much controversy over the text that whole phrases are in question. You have to make a decision; how big a phrase will you put into your apparatus? Are you just reporting a single word? In some cases, that single word will be incorporated into a larger word in a conjecture. And so that, so a person who's putting things together like that has to know something about what they're doing. (Classicist)

It also serves as a reminder to scholars that the text before them is one person's current "best guess" at a text which can never fully be recovered. This aspect of the apparatus will enter into the discussion again below.

Note that all this— the body of the text, information about the text, mechanisms for selectively accessing the text, and even comparisons to other editions of the text— are wrapped up for the scholar/user into *one single, discrete entity* separate from other editions and other texts. Note also that these "packages" or artifacts are not necessarily all easily available. Not every library will have every edition (or even a single edition of a given text), especially as some books are no longer in print.

Currently, an increasing number of ancient texts are becoming available in electronic form. As discussed above, their format is different from traditional textual editions. The TLG, which has set the tone for a significant set of databank projects, adopts a format that undoes the traditional coupling of text and commentary. This has both benefits and

drawbacks. On the one hand, it makes the entire range of a single corpus, including rare or out-of-print works, available in one place. This, according to one faculty member, is one of the TLG's greatest contributions to the field: if graduate students just see "...the range of texts that are out there, and sources, that's almost an education in and of itself. ...I think it really does give people a sense of a broader horizon" (Classicist).

On the other hand, it includes neither critical notes nor apparatus, and includes only a single edition. While other information about the text is still available, the scholar must turn to traditional books for it. To do so is considered essential to "good" scholarship.

> So, there's still a great deal of the very traditional type of scholarship, going from book to book, looking things up. Hoping that I have the right books here in my office, but every once in a while, I come upon some points, I'll have to go to the library for. (Classicist)

Scholars recognize both the advantages and limitations of this "package." One possibility for the future is the exploitation of hypertext to once again merge text and critical notes, this time on a more individual or small group basis. One vision allows the user to attach comment windows to words or phrases in the text which can be "opened" with the click of a mouse. Others could read and respond to these comments. While this may make for more interactive discussion of a text, it also drops out the editorial process entirely, relying not only on the judgment of the commentator, but on the judgment of the readers. Not all editions in book form are of superior quality, but nevertheless, they are at least somewhat guided and shaped by the editorial process within the discipline. So far, the widespread use of electronic, "interactive" forms of text is still a vision for all practical purposes.

New Tools for Searching

In order to use these texts for purposes of textual or literary criticism effectively, one must be able to locate words, phrases, or grammatical or metrical forms of interest. There are several basic tools that allow a scholar to search for words and phrases: indexes, concordances, on-line databanks and, of course, the human eye. These were discussed extensively in a previous chapter; I briefly review the different tools here.

Traditionally, scholars would use their eyes to scan texts for words, phrases, or patterns of interest. This method is still useful when a given text is not available on-line or the pattern of interest cannot be specified in a computer-recognizable form. The index is the simplest of the supporting tools and, as mentioned above, sometimes forms a part of a textual "package." For each major vocabulary word in a given text (usually omitting words considered "unimportant," such as articles), all the locations of the word in a given text or the works of a particular author are listed. It behooves the user to find the word in the text in order to see the context within which it occurs. Another traditional tool is the concordance,

most of which were compiled during or since the nineteenth century. Concordances differ from indexes in that they tend to include some context for the word, perhaps even a definition or translation. Again, the selection of the words to be included in a concordance is up to the editor. The style varies, words are generally located as separate entities or lemmas (ie. one can look up "book" but not the phrases "in the book" or "on the book"). As with textual editions, tools for searching were often created specifically for one work or one author's canon. Prendergast supplies us with a concordance to Homer's Iliad (Prendergast 1962), and Rengstorf with a complete concordance to the works of Flavius Josepus (Rengstorf 1983).

Nowadays, computers are being used in two ways to create tools for searching. In the first case, they are used to generate keyword-in-context concordances in book form, in which *all* words of a text are listed, centered on the page, with their surrounding text. One concordance produced in this way using a text from the TLG databank is a semilemmatized concordance to Euripides' play, *Alcestis*, created in 1977, the first of a series (McDonald 1977). The introduction states explicitly that the concordance is meant to supplement, not replace the 1954 Allen-Italie concordance and the 1971 Collard supplement, "...since no single concordance can serve all research purposes, [and they] are not ideal for particular kinds of inquiry into the language of Euripides" (McDonald 1977). In the second case, texts are stored in electronic form and can be accessed directly on a computer. Such on-line databanks combine text and search capabilities for the first time in electronic form.

One problem with all tools for searching so far is that they are based on a single edition. The following comments about the TLG could apply equally well to a concordance.

> The version of Euripides the TLG put in is Gilbert Murray's text, which is eighty years old, and now two-thirds replaced by a newer edition by a Cambridge scholar. That's now what people use for the authoritative text. You might do a search on the Ibycus and find something interesting, and then open up your newer edition and see that it was just Murray's choice, and Murray was wrong. (Classicist)

Now— and here is an interesting point which will be explored more fully later on— even though the same criticisms could be made of a traditional concordance, they only arise in interviews in conjunction with the TLG. When pressed, informants admit that traditional concordances have the same problems. The explanation would seem to be that classicists have different *expectations* of computers than they have of traditional concordances. The computer is expected to be objective, perfect: it "looks for what you tell it" and gives you "dumps of every place where [a word or phrase] is mentioned" (Classics Graduate Student). Concordances, on the other hand, have flaws: "you could never be as confident that you were covering things as well [as you could with the computer] because some of the concordances are way out of date. And even the most up-to-date printed Greek dictionary is designed on certain principles that are not designed for exhaustiveness" (Classicist).

6.2.1 Potential Ramifications

Electronic forms of texts and on-line tools for searching have the potential to open up new problems for analysis. The TLG has already proved immensely useful in identifying potential matches for extremely small fragments of papyri, as documented by Brunner (1988). Despite problems created by the lack of an apparatus, it is now possible to search a far greater amount of textual data in a fraction of the time it once took. Scholars can do more complete work, as they can search through a larger range of texts with greater ease. Recall the comments of the scholar searching for allusions:

> [With the TLG, I can] put up an all-Greek search on the screen, type in that word, tell the machine to search through, and then just turn my back and go about my work and 40 minutes later I look, the machine has a match for me. It will have that match from the Odyssey and if there are any others, they'll be there. And if there are no others, it will tell me there are no others. And, with only the amount of time it took me to type in the word and set the machine going, I'll have the answer. (Classicist)

Others state that they feel more confident about the claims they make because they are able to check a wider range of literature: "if I say this occurs once or three times, I'm fairly certain that that's true" (Classics Graduate Student). The accuracy and objectivity of the computer was often cited as one of the greatest merits of its use. Access to a wider range of information also has special ramifications for those new to a field and not as widely read as their "elders." A dramatic example of this kind of advantage presents itself in the case of one biblical scholar who wrote a dissertation on the concept of "disciple" in Matthew's Gospel. His dissertation, now a book, overturned earlier conclusions which influenced not only other scholars but also the doctrine of some Christian sects for the last forty years (Biblical Scholar).

Computer tools also change the kinds of questions scholars ask, and effect a shift in what is considered "acceptable work" for both faculty and graduate students. This change has been quite recent and rapid.

> In the "old days," two years ago, you could do a dissertation on a word study. Now, since you can get that information out of a computer, its not a topic any more. You have to *say* something. It will force people to ask more legitimate questions. (Papyrologist)

Similarly, semilemmatized concordances can now be prepared quickly and easily using electronic texts. New search abilities are changing definitions of good or complete work. There was once a sense of what an individual could do in a given span of time— what would be reasonable for a dissertation, how many authors one needed to check out in order to make a statement about something. Now, using the TLG for searching is becoming the accepted definition of "doing complete work."

The question of course is whether or not the ability to find *more* and to find it *faster* will lead to better— or even acceptable— scholarship. Some editors complain that the availability of computer-based texts and tools for searching allows scholars to do more careless work and less careful thinking about their conclusions. They blame the lack of critical materials and the low cost of massive searches (East Coast Classicist; West Coast Classicist). Indeed, searching is fruitless without some kind of critical knowledge, either residing in the tool or in the head. Consider the following comments about using the TLG:

> ...one of the things I'm working with is the corpus of decrees, of fifth century decrees. ...It's on the Ibycus, yeah. It's a little bit tricky to use because the orthography is in flux at this point. (Classics Graduate Student)

Orthography refers to established spellings; for it to be in flux means that a variety of spellings might be used for the same word. Let's say someone were interested in locating all occurences of the word "laugh." In Middle English, "laugh" might also be spelled "lough," "lauȝ,"[3] "louȝ," or perhaps even some other spelling. Because of these orthographic fluctuations, looking only for only the one spelling would not yield the desired search results. One medievalist writes about one of the manuscript versions of *Piers Plowman*,[4]

> I know about patterns of spelling. Words ending in the modern "ing" in the first half of the text end "yng"; eventually "ing" starts to appear. The "thorn" is invariably used except at the beginning of a line through the early part of the poem. At the middle of the poem, you start seeing the "th".[5] (Medievalist)

Similar fluctuations occur in Greek and Latin texts (Reynolds and Wilson 1974). As these examples show, it is still essential to have an understanding of a variety of aspects of text, language, and culture— including such details as orthographical shifts— in order for one to successfully analyze the texts and use the tools provided.

At a broader level, an understanding of the different kinds of literature, of the history, of the relationship between texts is still necessary in making decisions not only about the contents of a texts, but about which texts are relevant for a particular study. For instance, although the TLG includes a "tag" indicating genre, there may be some ambiguity about the attribution of an author or a given author's works. In some cases, no "tag" is included. If one wants to be sure to get all the lyric poets, or all the medical writers, it is still necessary to have an understanding of who those people are and how they fit into the larger corpus.

These examples demonstrate the many bits and pieces of knowledge one must acquire in graduate school or somewhere else along the way in order to use tools effectively. In the end, in classics as in other field or professions, it is time, practice, and a certain undefinable "knack" for the subject matter which combine to make the *expert*.

---

[3]I use the "ȝ" to denote the Middle English letter "yogh," the forerunner of our modern "y." It is often represented electronically by a "3" when no Old or Middle English characters are available.

[4]*Piers Plowman* is an alliterative poem written in Middle English. See footnote in chapter on classical scholarship for details.

[5]The "thorn" is a special Middle English letter that no longer exists in Modern English.

6.2.2 Changes in Work Patterns

The availability of on-line materials (if easily accessible) changes the kinds of sources to which individuals are likely to have access. One graduate student comments:

> When I want to know what X said, and I don't have a copy of the text, and I don't even know if the library has it, or I'm at home or at a place where the library isn't so good, I have everything right there [on the Ibycus]. (Classics Graduate Student)

Indeed, access to texts is absolutely vital to the enterprise of classical scholarship. This is one area in which databanks such as the TLG can serve as great equalizers.

> When you consider a classics department, you look at the quality of the faculty, the quality of the students, and the quality of the library. This is how you rank a department. The library is the factor which a school is least capable of controlling. For instance, [a South-Western university] ... started too late. Too many of the texts can't be acquired anymore. They can't become a distinguished program until everything is computerized. (Papyrologist)

Currently, one way to make up for deficiencies is travel. One scholar spends her summers traveling to Oxford to use the Bodleian library. As electronic databanks become more prevalent, more faculty and graduate will have ready access to these texts. Some have labeled this a "democratizing" process.

6.2.3 Values: Relationship Between Text and Scholar

On-line materials are often seen as interrupting or interfering with the very vital and alive relationship between the text and the scholar. Interviews with classicists highlight the special regard in which the text is held.

> I started where a scholar has to start— with the texts, the manuscripts, the textual tradition. (Hellenist)

> Having read five percent of the extant literature is different from having read twenty-five or fifty, or seventy-five. You read vast amounts of texts. ...It gives you a real sense of what X was like to have read it yourself. (Papyrologist)

Greater access to on-line materials may mean that individuals no longer read as intensively. Consider the response of a graduate student when asked what difference the lack of an Ibycus would have made to his dissertation work:

> It would make it [the dissertation] far more labor intensive. I could do it, but I would feel far more diffident. I would have to read, basically I would read through the orators, which is a pretty large corpus, and the philosophers, which is huge. (Classics Graduate Student)

New forms of presenting and accessing textual data have the potential to upset this traditional relationship. Consider these comments on the impact of the computer.

> The basis is reading texts. It's a general learning experience. There is a risk that computers will supplant that. When you read, you learn things that you aren't even searching for. The human brain may be searching for X, but will be confronted with other things. (Latinist)

> I find it quite salutary, as a matter of fact, not to have a computer [because] I sit down and read the stuff. (Latin Historian)

Many express an ambivalence about using the computer. They see both advantages and disadvantages. The advantages of using the computer are not always scholarly.

> [Using the computer for searching] detaches you from the work. ... sometimes you want to completely digest, master, live with the text. ... I'd like to just take two books and read and re-read them for a month like in grad school. The computer helps you cope with professional pressure [to produce papers in quantity]. (Classicist)

These quotations exemplify the often ambiguous feeling many humanists harbor towards computing.

6.3 Getting the Word Out: Writing and Publishing

The information technologies discussed above are ones created specifically for classicists: on-line textual editions and tools for searching. They replace or supplement other tools or technologies that, again, are classics specific: book editions, concordances and indexes. More general computer applications are also having an effect on the work of classicists, particularly word processing and electronic mail. Changes effected by the latter will be discussed in the following chapter. Personal computers coupled with word processing technologies have effected both the ways in which classicists create the products of their scholarship, books and articles, and their role and responsibility in the publication process. Let's consider some of these changes.

6.3.1 "Publish or Perish" and the Word Processor

Increased access to and reliance on word processing has changed the ease with which scholars can create and manipulate text as they produce journal articles and books. Traditionally, scholars wrote their manuscripts in long-hand, kept notes on index cards or slips of paper, and typed their final manuscripts. Many still use these methods; however, they tend to combine old methods with newer, computer-based methods.

> [I use the computer] in the sense of making notes all the time and typing up materials. But I also still use a card index to collect data. Sometimes I resort it onto the word processor, reorder it. (Classicist)

This is especially true of scholars who spend some of their time working in various libraries taking notes, then come back to their offices or homes to think about their discoveries and incorporate them into their drafts. For most scholars, the PC/word processor has become a regular feature of their work process, and they perceive it as a tool that helps them get the "real work" of classical scholarship done more quickly and more easily. As benefits scholars cite the ability to work with Greek and Hebrew fonts in a single document, incorporate notes from the computer, and extract Greek quotations directly from the texts available via the Ibycus. The ease with which they are able to write is critical in an environment (the university) which rewards the quantity of publications as well their quality (Classicist).

Using the computer is often seen as an enhancer of productivity precisely because it is easier to combine writing and editing, and because it is easier to incorporate electronically available materials into a draft (Papyrologist). This is of special importance for one specific group of scholars: those involved in critically editing texts. Consider two comments about how people carry out these tasks now that they have access to computing:

> When you are entering and editing texts, you can edit as you enter. You can tell from a fragment how many letters are missing. You can keep a master, and fiddle with it as you are trying to figure out what is missing. Before, you had to type it out. I invested in white-out as an assistant professor. For papyrologists, computers are wonderful. (Papyrologist)

Others use the computer similarly, typing in one version of a text, then modifying that version as they make judgments on the basis of comparisons with other texts. Notes about those judgments and any variants can also be stored electronically (Sutton). For many, this frees them from the tyranny of the white-out mentioned above, or the myriad scraps of paper that accompanied the traditional development of a critical edition. Again, this allows for a tighter coupling between the creative process (decisions about the text) and the mechanical process (recording the decision).

Those individuals who did not use a computer in their work, or who used it in an exceptionally limited way, tended to be established faculty members with access to a secretarial

staff. For some of these "reluctant users," using the word processor comes into play fairly late in the game, perhaps after the notes have been taken on index cards and the first draft written in long-hand. Reasons for this tend to fall into one of two "psychological categories" (for want of a better descriptor): aesthetics and fear. On the one hand, a different quality may be attributed to words written out long-hand. Writing is seen as a creative act for which the machine would serve as an impediment (recall the one scholar's comments about the computer alienating him from the text). It is often deemed more suitable for the lesser "bookkeeping" tasks, such as editing or footnoting.

> When writing, I have to write things out longhand. I use the WordPerfect [commercial word processing software] as an editing tool. It saves lots of time organizing, indexing, footnoting. For pure creative energy, I cannot sit in front of a screen. I have to feel the pen in my hand and feel the paper. (Classicist)

Heim (1987), in his philosophical examination of word processing, offers a more detailed discussion of the aesthetic qualities of handwritten vs. type- or computer-written text.

For others, it is an often intense fear of the computer, coupled with a lack of knowledge about computing (and frequently an unwillingness to learn), which prevents them from adopting a PC/word processor as a primary writing tool.

> I write out things by hand. I have always done scholarly writing, scholarly correspondence by hand. What I create on my own I do by hand. I've made deliberate attempts to break the barrier [learning to use the computer]. I've composed three book reviews on the IBM PC. It's the most limited kind of task I do, with the least amount of creativity. It's limited in scope, you know what you will do before you sit down. These are the only places I've done first drafts on a PC. . . . I'm not mechanically oriented or interested. (Classicist)

This person, a senior faculty member at a major institution, relies on his graduate students for help. This suggests that age might be a possible factor, and it is probably a contributing factor, as younger members of the profession are more likely to have grown up using computers. One commercial typesetter who specializes in academic books and handles a great deal of work of classicists (and has a background in Classics) says that "the older generation has been slower to jump in [to computing]" (Commercial Typesetter). However, others explain the reluctance differently. Classics "self-selects" individuals who shun innovation: "People become classicists because they like stability, tradition, because they're inherently conservative" (Tool Developer). But avid computer users can be found among the oldest, most established members just as much as among the younger generation, while several of the individuals who expressed a reluctance to use the computer were younger members, either graduate students or junior faculty. Without hard data on computer use, age, length of tenure on faculty, and so forth, it is not possible to make any conclusive statement about the correlation between age and innovativeness. Research on diffusion, however, suggests that other factors are more important in identifying those likely to become early adoptors

of innovations. They typically are people more "outside" their organization or social world than other members (Rogers 1983); they tend to be on the "fringes" of their social group (Rogers and Shoemaker 1971), and to be of either high status with little to lose or of low status with much to gain (Mulkay 1972).

As word processing becomes the norm rather than the exception, those who do not convert over to it are being seen as "old-fashioned" and as placing themselves at a disadvantage within the scholarly community.

> I do have a concern: some scholars jump into computer use and have become more productive, as I have; others resist it and are being left behind. I recently received a paper from a grad-school friend of mine. He wanted me to critique it. The paper was okay, needed some work, but it was typed on a mechanical typewriter. I know he is not a fast typist, and the labor of retyping it three to four additional times before it is right may well discourage him from getting back into scholarly writing. (He has had overseas projects lately which did not involve writing.) (Classicist)

This value judgment about the expected quality of the end product recalls to mind a comment of Heidegger's about the shifting desirability of typewritten texts: "When typewriters first became prevalent, a personal letter typed on a machine was regarded as a lapse of manners or an insult. Today, handwritten letters slow down rapid reading and are therefore regarded as old-fashioned and undesirable" (Heidegger, *Parmenides*, quoted in Heim 1987). The comment also highlights another issue, harking back to the previous section on textual editions and tools for searching. Word processors, by virtue of allowing individuals to manipulate text directly on-line, also allow a different interaction between the mechanics of document creation (the typing) and the "creative process" of thinking about things, trying out ideas, and so forth.

Finally, let us address the question of *quality versus quantity*, and what one editor calls a "cut-and-paste mentality." Does *more* imply *better*? Many scholars praise the computer for making it possible for them to write longer books and longer articles. Editors, on the other hand, don't necessarily find a corresponding increase in quality. The editor of one major classics journal laments that their submissions get longer all the time, and they have had to ask contributors to cut up to twenty percent. He attributes this to the ease of word processing, and adds, "Now, maybe that happened before computers, I don't know, but my colleagues on the editorial board tell me no, that they think it's really a word processing phenomenon."

Some also find that the use of the word processor also changes the way they edit their own manuscripts. One scholar writes, "With the PC, I spend all my time editing one paragraph instead of writing" (Haley). Another scholars finds that he tends to limit his editing to what can be seen on the screen; to combat this, he makes printouts of larger sections of a text when major *conceptual* revisions are called for. This relates directly to a concern of

journal editors who find that requests for revisions are met with what one editor calls a "cut-and-paste mentality":

> What I have noticed in terms of quality is that people have become very lazy in revisions because of word processing. ... they'll add something on this topic, drop something on this topic; they take [reviewers' comments] very literally, ... because they don't have to rewrite it, the way you would if you were working on a typewriter or something .... What you were really asking for was a rethinking of the whole argument .... (Classicist)

In some cases, this editor sent back the revised manuscript, refusing to accept it unless it were rewritten and the argument restated, on several occasions leading to extremely angry reaction on the part of the submittors.

Many comments and work habits of classicists are echoed by contemporary writers and journalists interviewed by Hurwood (1986) for his book, *Writing Becomes Electric.* Many of them combine "on-line" and "off-line" habits, and some find that they still write out first drafts (or even second drafts) long-hand. Different kinds of tasks may also elicit different styles: "... when writing reviews, I like to write first on the machine, then correct them by hand, and then use the machine again. I think Ernest Hemingway did dialogue on typewriters, physical descriptions by pen, and I understand that perfectly" (Michael McGrady, quoted in Hurwood 1986). They cite the ease of revision as a definite advantage, though many prefer to edit from a printout. Many writers found that writing on the computer allowed them to write more freely: "I think using a word processor has allowed me to be more creative ... because I now feel that I have a word space that is totally mutable and instantly perfect" (Eric van Lustbader, quoted in Hurwood 1986) though at least one individual commented that using a computer also makes people more careless in their writing (Patrick M. McGrady, Jr., quoted in Hurwood 1986).

6.3.2 Blurring the Lines Between Scholar and Publisher

Before personal computers and word processing programs were readily available to individuals (that is, pre-mid-1980's), scholars would complete a manuscript, send it to a publisher, who would send it to a typesetter. It would wend its way back to the author for corrections and, after a few rounds perhaps, the page proofs would be sent to the printer and the book would be published.[6] Although this is still how things work in the majority of cases, it is slowly becoming more common for individual scholars to provide an electronic version of their documents. An increasing number of publishers are accepting— even

[6]Classics, incidentally, is not a field in which findings are rushed into print; in some cases, it can take several years before a book or article is published (Sutton).

requiring— manuscripts in electronic form. There are several reasons for this: cost, accuracy, and ease.

Typesetting costs money. As opposed to the best seller markets, where authors get an advance in anticipation of extensive sales, classicists often have to pay to get their books published. This is especially true of works that are unlikely to have a reasonably-sized readership, such as a collection of articles in someone's honor, termed a *Festschrift*, and often compiled by colleagues on the honored colleague's retirement. The university may pick up the tab for typesetting costs, or special departmental funds may be allotted to pay for publication; in the case of a *Festschrift*, the contributors may each also send a financial contribution, and others may be asked to contribute in return for their name being placed on the frontispiece (Biblical Scholar, Classicist). In one case, a book that cost $3,500 to publish would have cost an additional $3,500 to typeset (Wilkins); an edition of a Festschrift was even more expensive:

> I think it cost us $5,000 to get it into production, but that was from camera-ready copy. It would have been another $10,000 if we would have had typesetters do it. (Classist)

By taking over a great many of the aspects of manuscript preparation, the editors not only saved money, but also time. They also had far greater *control* over the process and over the presentation of the materials.

> [Having a typesetter do] it would have involved a lot of different stages; this way we did all the proof-reading while we were preparing, doing the formatting and when we got the camera-ready copy, then we read that. So, that was something the computer really helped us with. Editing things for uniformity would have taken a lot longer if we would have had to do it hand written, send it back to the author, say, here, retype this, or we would have had to hire someone to retype it. And the production of the book itself would have taken longer and been more expensive. (Hellenist)

The issue of control is particularly salient in an environment in which one is judged by what appears in print. In dealing with typesetters and editors who are not proficient in Greek, there is always the danger that quotations and commentary will not be accurately reproduced, or that corrections would not be incorporated. And by taking on many of the burdens of typesetting, classicists might be able to convince a publisher to accept a daunting job.

> It's crucial, how one can make use of word processing technology in order to make difficult, complex, threatening-looking typescripts seem manageable to publishers. I'm worried; I've put in twenty years of my life into this work [a commentary on Aeschylus which charts half a dozen different manuscript readings]. I don't want it to come up short because I can't produce something anyone wants to touch. (Hellenist)

He anticipates that it will take six months to convert his manuscript, but considers the time investment to be worthwhile when compared to the amount of time spent on the manuscript itself.

Preparing a manuscript for publication, however, is also both time-consuming and requires a certain set of skills. In the case of the Festschrift mentioned above, the editors received contributions electronically from people using several different word processors on several different machines. Before they could consolidate all the various documents, they had to convert them to one single format; and in order to do that, they had to find the appropriate PC's, word processing programs, and conversion programs.

6.4 New Expertise

> Laymen [in the Middle Ages] became more literate in order to cope with written business, initially in England with write from the royal government demanding information or money. Knights involved in county business, and even peasants who acted as manorial reeves, needed to be able to read the warrants presented to them and to keep records themselves in order to make adequate answers. (Clanchy 1979:258)

Just as literacy became a requirement for the knights and laymen of the middle ages, so "computer literacy" is becoming *de rigueur* within the academic community and beyond. Recently the central character of a popular comic strip, "Crankshaft," walked into a library to find a book. Instead of being directed to a card catalogue, he is shown a computer. His first reaction is, what does a computer have to do with books? The answer, of course, is that nowadays the computer has something to do with just about everything.

What does this have to do with expertise? Most basically, expertise is defined as a "special knowledge or skill"; new technologies or changing customs and norms may require individuals to acquire previously unnecessary expertise. Both the knowledge and the skill are really integral components of expertise, as expertise involves not only a "disembodied collection of symbolic rules, ... [but] also involves the manipulation and construction of a material environment" (Wieckert 1990). Perhaps the most important component of expertise is what Polanyi and others called *tacit knowledge* (cf. Polanyi 1967, Star 1989) and what Collins (1987) refers to as *cultural skill.* Tacit knowledge cannot be captured using knowledge elicitation methods from artificial intelligence, as the holders of this knowledge cannot articulate it: "people don't know what they know" (Collins and others 1985). This kind of knowledge— indeed, the entire "package" of expertise[7] — is generally acquired through an apprenticeship, in which the learner works with the expert to "pick up" knowledge that cannot be formally encoded or transmitted.

[7]See Wieckert (1990) and Weickert (forthcoming) for a discussion of expert *systems* as packages and the dimensions of expertise.

Classicists are already experts, and by the time they gain a faculty appointment, they have already undergone an "apprenticeship" of sorts, graduate school, in which they have received both formal and informal training. At a bare minimum, classicists must possess a certain intellectual expertise, such as a knowledge of Greek and Latin, and they must develop the skills needed for textual and literary criticism. By the time their doctoral degrees are conferred upon them, they already possess a vast array of special disciplinary knowledge and skills, particularly in their respective subdisciplines.

This expertise has been slowly acquired over a number of years, for some starting with their first Latin or Greek course in high school. As graduate students, they often spend years developing their language skills and developing a knowledge of the corpus of Greek and Latin literature, and learning the techniques applicable to their own chosen specialty. They must also pass reading exams in German and French. In the course of their graduate studies, budding classicists must also develop a sense for evaluating questions and problems within their discipline both in terms of their do-ability and in terms of their interest to others in the field. They must continue to refine this skill as progress is made within the discipline or as new techniques and technologies are introduced. Classicists must also know how to use institutions and organizations such as libraries, journals, publishers, and funding agencies to support and disseminate their work.

The introduction of new technologies to support research has had an unexpected side-effect. Classical scholars must add an increasingly sophisticated level of computer-related technical expertise in order to efficiently and completely gain access to the information required for carrying out their work. They must develop a new expertise that includes not only formal rules, heuristics, and manual and perceptual skills about computing generally or about specific systems, but must also develop a new set of *cultural* skills that facilitate their use of these technologies. Formal rules and heuristics can be learned from classes, workshops or manuals. Cultural skills, however, include local knowledge such as how to obtain help with and resources for this new technology. And computing expertise may blend with "traditional" scholarly expertise, such as knowing when a search is going to be too big for a particular machine to handle, and either restructuring the search or using a different machine.

Consider the perilous journey into the realm of computer technology taken by a classicist writing a book on prices in ancient Greek, who wished to create an electronic version of the Delos *hieropoioi* inscriptions for search purposes. The only computer available to him was the university's IBM mainframe, and in the course of his efforts he had to learn to use the mainframe, write programs, and operate an optical scanner. In a letter to me he writes,

> It is true that the computer eventually produced for me [the list that I needed]. It would have taken me more than a year to compile such a list myself; the computer did it in about a minute. Since, however, it took me three years of preparation to get the computer to do what it did, I doubt that I saved any time— and those

> were three years when my mind was dealing with electronics, not with ancient prices. (Israeli Classicist)

Would this project have been any easier if the texts had already been available on line? This is the case with the TLG, but experiences with the package depend on the date and time of original acquisition. Individuals and departments acquiring the TLG in the mid- to late-70's when it was available only on tape for use with a mainframe faced daunting problems. One classicist remarks:

> The person directing the information systems ... let us buy all the tapes, and eventually allocated us space on the mainframe. ... [We got some programs from another university, but] we were ... unsupported by the technical staff here except for installing, of course. ... There was a humanities computing consultant here for about a year ... and he taught me enough that I have added extra data to the databank; I used some of the program to make indices, things like that, and I've even written a few short scripts [for searching] myself .... (Classicist)

This person is not computer-phobic; he also knows how to use a Macintosh, the Ibycus, electronic mail, and electronic bulletin boards. While he is certainly *able* to learn to use the computer, he complains that learning all these different tools and features takes up too much of his time.

With the development of the Ibycus and the subsequent availability of the various texts on CD ROM, the user no longer had to engage in any serious programming efforts. However, even in the event of a purchase of the stand-alone Ibycus with complete TLG texts, the user must master not only the search command structure, but must develop some understanding of the operating system and file system. The other option— CD ROM and a ROM reader connected to a PC— requires the user to obtain and set up the necessary software to connect the two. This presumes a familiarity with the PC that not all classicists possess.

6.4.1 Acquiring the New Expertise

> Now, as I see it, the question of how we integrate the new technology into the humanities is the question; that is the question of the 90's; that is the question for anyone starting today. And it will be the dominant question for their whole career. And there's no escaping it. (Tool Developer)

These new learning processes are time-consuming and do not tie in with the main "mission" or focus of classics as perceived by scholars carrying out the work. There are two ways to accommodate new needs for expertise: acquire it or figure out where and how to access it. Both consume time and energy and make different kinds of demands on faculty and graduate students. In order to acquire the necessary expertise, individuals may figure things out on

their own using manuals, participate in campus-sponsored workshops (such as Stanford's now-defunct Tyro project), join users' groups (such as the Macintosh users' group at UC Berkeley), or identify individuals within their department who can show them how to carry out specific tasks.

The predominant method of learning relies on interpersonal exchange of information, and is usually very task-specific. For instance, one might start out learning to do searches of the entire databank, then upon starting up a research project involving only a small group of authors, learn to create a file of specific authors to search. A faculty member at a major university describes the typical pattern for learning to use a new technology: "I would say very few people here have learned very little information from a manual. We've all just kind of taught each other. ... It's much easier to learn from a person than a manual if you have a community of users around" (Classicist). In most departments, two or three "computer gurus" emerge.

6.4.2 Emergence of a Technical Culture?

Peter Lyman (1984) writes about the impact of computer technologies on sociology, that "consuming the norms and concepts of technical culture may shift the craftlike norms of the field worker's culture." Could this phenomenon occur in classical scholarship? It certainly isn't the case at the moment, and history tends to support the expectation that classics will never become such a "technical culture." As noted above, the computer is not the first new technology (used in the broader sense to include *technique*) which classics has incorporated into the discipline. Consider new developments in media for the preservation and dissemination of texts, such as vellum or the printing press. Medieval scholars did not become illuminators; renaissance scholars did not become printers. Or consider the development of early critical methods and tools (at Alexandria) or the creation of concordances in nineteenth century Germany. Even when individual classicists devoted much of their time to these enterprises, classics as a whole remained relatively untouched. The same *kinds* of questions scholars debated in Alexandria still resound within the halls of Yale or UC Irvine.

This doesn't mean that classicists will shun the use of these new technologies; the evidence points in quite the opposite direction. Classicists *are* incorporating computing into their work. For some, computing is even becoming a central component of their work. The next chapter discusses the emergence of these new social subworlds which are focused around an interest in the application of computing to questions in the Humanities. Still, for most, the utility of using the computer, just like the utility of any tool, will be measured by the criteria of *the work they do*: "How can I forget about what needs to be done in terms of scholarly work in order to learn to use the computer?" (Hellenist).

What does seem to be emerging, though, is a group of individuals who are trained in a humanistic discipline, yet either choose not to continue on in an academic career or are unable to successfully negotiate such a career in a very tight and competitive market. With an interest (and usually some expertise) in computing, and an understanding of the problems and concerns of faculty in the humanities, these individuals are becoming humanities computing consultants or staff members on tool-building projects, or are turning to other jobs that link computing with humanistic disciplines. I have no concrete data on this, in part because this is a very new area; however, judging from anecdotal evidence, this appears to have the makings of a trend (perhaps even a new social world— read on).

6.5 Summary

New media can change the way information is represented, distributed, accessed and manipulated. Earlier shifts, such as the transition from orality to literacy and the transition from scribal culture to the era of the printing press can help us understand and anticipate impacts of computing technologies. Indeed, new information technologies are changing the representation of the data classicists use, the tools with which they access that data, and they way in which they present and disseminate their conclusions. In particular, increased use of information technologies now require classicists to develop a new set of expertise beyond the traditional expertise that formerly sufficed to carry out classical scholarship.

Chapter 7

New Patterns of Interaction and Emerging Subworlds

> The social state is at once so natural, so necessary, and so habitual to man, that ...he never conceives himself otherwise than as a member of a body.
>
> — John Stuart Mill, *Utilitarianism*

Previous chapters have been more "inward-looking" in that they have focused on the relationship between the individual classicist, the nature of the work, and the tools and artifacts that support classical scholarship. In this chapter, we look outward to better understand the interactions between classicists and other individuals and organizations, in the course of scholarly activity. These interactions have been and continue to be altered dramatically by the introduction of new information and communication technologies. We focus here on two different aspects of these transformation.

First, the increased use of computing technologies for both remote access to information and electronic communication extends the kinds of information to which classicists have access. Electronic communication, in particular, creates new opportunities for interaction with members both within and without the traditional boundaries of the social world of classical scholarship, expanding the communications network. Secondly, a new social world may be forming around shared interests in humanities computing. As interests surrounding computing in the humanities develop, intersections of established social worlds create new worlds centered around these interests. Members of this world are not limited to classicists, but include individuals interested in computer-aided instruction, educational networks, computer literacy, and so forth. In this chapter we examine these phenomena.

7.1 Mundus Electronicus

The increased use of computing technologies for both remote retrieval of information and communication has changed the "world" of the classical scholar. New technologies make it possible for the scholar to gain access to information that was not easily accessible before. Using on-line bibliographic systems, scholars can locate books at libraries in other cities or countries. Using electronic mail, scholars can communicate easily with colleagues in other parts of the world or join "electronic communities" via on-line bulletin boards or mailing lists. They can even subscribe to electronic journals *not* available in "paper" form, such as *Postmodern Culture.* As these technologies increase the amount and range of information which is available to the scholar, they also increase the need to more carefully filter that information. And finally, they alter the support infrastructure needed for maintaining information and access to it. Below, I take a more detailed look at the different kinds of opportunities provided by electronic communications technologies.

7.1.1 Electronic Access to Data

Many classical scholars use texts as their primary data source, and interact with libraries and archives in order to obtain them. The library sciences, instrumental in cataloguing and managing text collections, are well established. Procedures for using or borrowing texts may vary from library to library and archive to archive, but they are already fairly well-established within the social world. Libraries publish catalogues of special collections or listings of archives on special research topics. Some textual materials can be loaned from a remote library or archive for a specified period of time, under specific conditions. Sometimes photocopies or photographs can be obtained in place of the originals, but sometimes because of the nature of the work or the condition of the document, the materials must be used *in situ.* Travelling to the physical location of a textual source is, of course, not a new phenomenon. At one point it was almost the only way to access a collection. In antiquity, libraries such as the one at Alexandria collected not only texts, but also scholars, and in the Middle Ages, scholars might travel to a particular monastery to use the texts located there. Today, they may travel to Oxford or Cambridge to use these universities' collections; special funding sources exist to support and facilitate this kind of travel.

Increasingly, scholars may "travel" electronically via access to on-line card catalogue systems and electronic versions of texts not available to them in paper form. This is especially useful for those classicists not located at major research institutions with old, well-established libraries. One classicist— the only one in the Foreign Language Department at a four-year public college with an emphasis on teaching rather than research— writes,

> The single most valuable computerized resource outside my office has been the interlibrary loan service. This much ignored–but absolutely vital service for scholars outside of the major research institutions with big libraries–is tied into OCLC[1] and RLIN[2] ...and to MELVYL, the UC [University of California] and CSUS [California State University System] catalogue. I can also access MELVYL via modem from my office. This is good for bibliography, even tho' not all UC holdings are on MELVYL. (Classicist)

Such electronic services, of course, must be coupled with some kind of mechanism to *deliver* the materials of interest. Without the *physical* and *organizational* component of the inter-library loan service mentioned in this example, the scholar would have to make personal arrangments to borrow and retrive the necessary materials. By having established mechanisms (including established borrowers' agreements, mail services, and so forth), scholars are relived of these sorts of details.

Successful use of these systems also requires the ability to extract information from them. In a critique of the state of computerization in the Humanities, Schmitt (1990) decries the current situation in which scholars must often rely on skilled intermediaries, primarily librarians, for using on-line search services. This is, in part, due to the average scholar's lack of expertise in "maneuvering through the specialized language of computer commands." It is also the fault of designers of computerized bibliographic systems, the output of which is often presented to users as "a jumble of abbreviations, numbers, and formatting codes that bears little resemblance to the standard style of bibliographical citations in [the scholar's discipline]" (Schmitt 1990).

According to Schmitt (1990), a reliance on "experts" can have a dramatic impact on the rhythm of scholarly work.

> The use of intermediaries to conduct on-line information searches, whether for bibliographic references or primary data, signals a significant change in research practices. What will happen in this environment to the essential role of browsing, of wandering until you find what you are looking for, and, more important, what you did not expect to find?

Schmitt acknowledges that new technologies, such as the CD ROM, serve remarkably well as tools for storing information. However, she argues that they will not solve the basic problems of learning new commands for different data bases, bridging terminological gaps between the searcher and the database, and finding out about the existence of databases or bibliographic systems in the first place.

Some other "start up" costs connected with on-line card catalogues also plague universities as they move from paper to electronic systems. While electronic systems clearly have

[1]The Online Computer Library Center, Inc., is a national bibliographic utility based in Dublin, Ohio.

[2]Research Libraries Information Network is an international information management and retrieval system supported by the Research Libraries Group, based in Palo Alto, California.

advantages, their utility may be limited if they are incomplete because of in-progress data entry of university holdings. At UC Irvine, for instance, some older materials have not yet been included in the on-line card catalogue system, which will have less of an impact on individuals who rely on "up-to-date" findings (computer scientists, for instance, rarely if ever turn to work written in the 1800's in their research), but could have a great impact on scholars in the humanities who draw on older traditions.

> MELVYL and GLADYS [two on-line card catalogue systems], they are useful, but incomplete. You have a false sense of what's available if you've only looked at them. (Latinist)

On the other hand, space limitations and a non-uniform cataloguing system may make stack browsing much less viable than electronic browsing, once one knows how to use the on-line card catalogue. This is an especially salient issue in institutions where library holdings are physically dispersed over the the campus.

> The library at [this university] is poor for browsing. There are two kinds of cataloguing systems, Roull and Library of Congress, plus books may not be in the stacks. The old ones are shipped off [to a storage facility]; they may be on reserve [placed in another room for use by students in a particular class]; there are a whole host of places they might be. The computer gathers them together, it's more useful for browsing. (Latinist)

Libraries are changing their approach to bibliographic instruction to include the electronic components of the "automated library" (Battin 1984, Mellon 1987, Wagner 1990, Wheeler 1988). Perhaps learning to use computer-based systems effectively should be considered a part of learning to use the larger "information infrastructure"— including libraries, journals, colleagues, reference work, bibliographic systems and so forth— effectively within the context of one's work.

7.1.2 The Politics of Knowledge

> A wise man is strong; yea, a man of knowledge increaseth strength.
>
> — King James Bible, *Proverbs 24:5*

Beyond technical and physical considerations, there are also *political* considerations, or what I'll call the "politics of knowledge." John F. Kennedy might have been referring to the writings of Bacon[3] when he stated that "in a time of turbulence and change, it is more true than ever that knowledge is power."[4] Access to data is closely linked to power. Lasswell

[3] "Nam et ipsa scientia potestas est," from Francis Bacon's *Meditationes Sacrae*.

[4] From an address at the University of California, Berkeley, March 23, 1962.

(1971) equates shared data with shared power, a monopoly of data with a monopoly of power. Increased power has been one of the motivations for the use of information technologies at various levels of government (Dutton and Kraemer 1985, Frantzich 1982, Kraemer and others 1987); and the control and harnessing of powerful knowledge is one of the motivating forces behind the expert systems bandwagon (Wieckert forthcoming). Classicists have had a number of bases for data monopolies in the past: as teachers, as established researchers, as scholars located at wealthy or well-established institutions. Electronic access to data is changing this.

One kind of knowledge-based power distribution is exemplified by the faculty-student relationship, commented upon by Martlew (1990):

> In crude terms, university lecturers control the educational process by controlling knowledge. If the topic is central to their own research, they will be steeped in the latest facts and opinions— published and unpublished. If the topic is not closely related to their own work, as is often the case in these days of highly specialized research, their power is based on familiarity with the subject through having taught the course before, or through having access to source material in advance. This position of power is confirmed by examinations, set and marked by those who have taught the courses, which emphasize the recall of factual knowledge.

A similar "power inequity" exists between institutions and is based on the quality of their libraries (often related to not only the wealth but also the age of the institutions). Earlier I quoted an informant who said that to judge a classics department, one looked at the quality of the faculty, the students, and the library; and that, because of the difficulty of acquiring some texts, many a department "can't become a distinguished program until everything is computerized" (Papyrologist).

As more information is accessible on-line, the new "base of power" may become an intersection of personal research and past teaching experience, coupled with the ability to extract information from new computer-based bibliographic and electronic text databanks. Note that the one certainly cannot *supplant* the other; the mere access to information guarantees nothing about the quality of the synthesis one prepares from it. One classicist compares thoughtless use of tools such as the TLG to indiscriminate photocopying.

> Machines allow work to be done without having done any intellectual work yourself. ... A xerox machine does it, the word processor, the Ibycus. ... Eventually you're going to come to the day where you realize that you've xeroxed a stack of articles this high but you're either going to read them or not, and they're not going to be any use to you. And you can print out a stack of word searches that high [gestures a few feet off the ground] on the Ibycus and eventually you're going to have to confront it and either do something with it or not. (Hellenist)

However, brilliant mental abilities can be thwarted by the lack of particular technical skills within the context of an electronic environment. Recall earlier comments about the deleterious effect of inordinate reliance on intermediaries for information access. But consider also the point Greenberg (1990) makes with respect to shared views in computer applications to support group decision making and collaboration: "First, not all participants may have experience with a particular shared application. ... If a participant's editor is not selected for sharing, he becomes a second-class citizen in the meeting." If this is an issue in the context of a single shared-window system, what problems will arise with respect to the plethora of bibliographic and text databanks that are becoming available to users within the academic community? As discussed in the previous chapter, expertise in a given discipline will cease to be sufficient, unless coupled with the technical expertise required to discover and retrieve relevant information, and even the necessary components of technical expertise will be up in the air.

7.1.3 On-line Journals and Books: *Postmodern Culture*

> Forget your medieval obsession with the Book. A new journal called *Postmodern Culture* is the first juried periodical in the humanities to be distributed entirely via electronic mail— or computer disc. This is a manuscript illuminated only by the glow of your computer screen, a forum in which the bits and bytes of computer culture meet the mix and match of the pomo aesthetic. (Edidin 1990)

In summer 1990 a new journal, *Postmodern Culture* (PMC), was announced.[5] The journal is described as peer-reviewed, and as providing

> ... an international and interdisciplinary forum for discussing contemporary literature, theory, and culture. It emphasizes open debate and intellectual engagement: readers may respond to essays and their comments will be made available to the authors and to other readers. (mail received from the editors at bitnet address pmc@ncsuvm)

This in itself is not particularly interesting or significant. What is significant is the fact that the announcement appeared not in my mailbox nor in a journal I was reading, but on my computer screen via the electronic mailing list, *Humanist*, and that this journal is distributed in *electronic* form.[6]

In many ways, PMC is no different from a traditional journal. It is "juried" or refereed, with submissions sent to the editor; accepted, rejected or sent back for revision; and then

[5]The journal's three editors, all assistant professors of English at North Carolina State University, are Eyal Amiran, Elaine Orr, and John Unsworth. The contact address is: *Postmodern Culture*, Box 5657, Raleigh, NC 27650.

[6]*Humanist* is an electronic mailing list on humanities computing. It is described in more detail below.

distributed to its subscribers. Submissions are accepted via electronic mail, on disk, or in hard copy. Its electronic format, however, allows for a much more interactive discussion than is possible in response to submission to traditional journals. The "open debate and intellectual engagement" mentioned in the editors' introductory message is fostered by means of an electronic discussion group, PMC-talk, which allows members to post comments either on the submission itself or as a response to earlier comments. A critical difference between PMC and Humanist is that whatever members of PMC send to the discussion group is immediately forwarded to all subscribers without the intervention of editors who collate and, on occasion, reject messages. This last "feature" prompted a reminder by the editor, John Unsworth:

> ...anything mailed to the address pmc-talk@ncsuvm [the electronic discussion group] will automatically be distributed to all the list's subscribers, so if you have questions, problems, or other mail that does not concern the whole discussion group please send that mail to pmc@ncsuvm [the editors' electronic address]. (mail received Thursday, June 21, 1990 from pmc@ncsuvm)

The same mail message from Unsworth raises a technical issue:

> Also, if you are subscribing from Compuserve [a commercial electronic mail server] I have just found out that there is a size limit on the mail you can receive (if you are an individual, rather than a corporate user), so you will not have received the Whole Earth article Chris Maeda sent. (mail received from pmc@ncsuvm)

Unsworth notes that he is trying to work things out with the Compuserve postmaster. The journal is also available on disk or microfiche at $15 for individuals and $30 for institutions, with additional charges for Canada and overseas; electronic distribution through Bitnet and Internet is free.

7.1.4 Expanding the Community: Electronic Communications

The use of electronic mail for interpersonal exchange and for participation within larger group is changing the kinds of people with whom classicists interact and the kinds of information to which they have access. At this point, the discussion involves only a relatively small group of individuals. Although the use of personal computers, electronic databanks, and on-line bibliographic systems is no longer an anomoly within classics, few individuals interviewed were active users of electronic mail.[7]

[7]In the following sections, I talk about the development of an "electronic community." I most certainly do not use it in its sense of a collection of geographically co-located individuals. Instead, I draw on Nisbet's (1973) definition of the word *community*, of which he writes, "I use the word ...in its oldest and lasting

Electronic Mail in Other Contexts

I shall now review literature evaluating the impact of electronic communications technologies in a variety of academic and non-academic settings. As yet, electronic mail is a relatively new phenomenon and the emerging literature, as yet, presents us with a body of often contradictory or inconclusive results. Eveland and Bikson (1987) find their data suggests "that electronic links enhance existing interactions, rather than initiating interaction patterns that were formerly not in evidence." Users were most likely to communicate with those nearby than they were with those far away. Contact, they discovered also tended to be *intra*-program rather than *inter*-program; people interact around joint projects. On the other hand, other studies indicate that users may establish significant ties to peers on a network, occasionally even to the exclusion of their "face-to-face" colleagues (Freeman 1980, Hiltz 1984). Feldman (1987) found that electronic mail supports the weak ties in an organization, fostering communication between those who might otherwise have no contact with each other.

Use by individuals or groups could not be predicted on the basis of some set of characteristics, but was rather an "intersection of preferences and task requirements." Most often, network participation was directly related to the fulfillment of organizational duties (Markus 1984, Lederberg 1978), though membership in electronic groups is often based on personal or recreational interests (Finholt and Sproull 1988). The asynchronous capabilities of electronic mail makes it an ideal medium for communication between members in different time zones or with different work schedules (Eveland and Bikson 1987, Rice and Bair 1983).

Sproull and Kiesler (1986) conclude that electronic mail can lead to the exchange of new information, which would have not been exchanged or conveyed through other media. They find especially that electronic mail reduces social context cues, such as status, and that this led to less inhibited message exchange. When electronic media are used in the decision making process, the lack of context cues can lead to more uninhibited and more equal contributions on the part of group members, and a longer period of time before consensus is reached. Electronic mail can alter traditional communication patterns (Bikson and others 1989) and can increase lateral communication (Turoff and Hiltz 1982). It can also serve to introduce new information into the electronic community: "information respondents reported they would have gotten (or sent) no other way if there were no electronic mail" (Sproull and Kiesler 1986).

---

sense of relationships among individuals that are characterized by a high degree of personal intimacy, of social cohesion or moral commitment, and of continuity in time. ...All that is essential is that the basis be of sufficient appeal and of sufficient durability to enlist numbers of human beings, to arouse loyalties, and to stimulate an overriding sense of distinctive identity." However, I use it more loosely to convey a sense of social cohesion established by sharing information and developing a shared (electronic) history over a period of time.

The "access equalization" afforded by electronic media gives users contact with groups that they would not have had under other circumstances (Rice 1984). Indeed, some expect electronic networks to promote the growth of new groups organized around common interests rather than proximity (Hiltz 1984, Lederberg 1978, Rice 1984). The emergence of international electronic mailing lists based on a variety of issues in the humanities, from text encoding to the use of specific data banks, tends to support these expectations. Finholt and Sproull (1988) evaluate such electronic groups, defined by electronic distribution lists based on common interests, and discover that electronic groups exhibit characteristics of real social groups despite the facts that they share no physical space, their members are invisible, and their "interaction" asynchronous. Some of the groups they observed had a hundred or more members in different cities. They speculate that, for lower level employees with few opportunities to make organization-wide contacts, distribution lists may serve as their "window on the corporation."

Acceptance and availability are key factors determining use (Steinfield 1986). Tombaugh (1984) reports that the cost of gaining access to electronic networks is an important factor for many users; in a study of an international scientific computer-based conference, she found that scientists in developing countries, many of whom did not have easy access to terminal equipment or telecommunications, were most concerned about technical issues, as opposed to their counterparts in industrialized countries whose focus was on organizational and social problems of computer conferencing.

What kinds of organizations have thus far contributed to our understanding of the potentials of electronic mail by serving as settings for analysis? Eveland and Bikson (1987) spent eighteen months reviewing the implementation of a mail system within a nonproprietary policy research organization of about one thousand individuals on two coasts. Sproull and Kiesler (1986) base their results on a study within a "Fortune 500" office equipment firm employing over one hundred thousand people. Consider their description of the "well-established" electronic community which they surveyed:

> On average [the firm's] policies and procedures made it very easy to use [the electronic mail system]; people found the program itself easy to use; they and their work colleagues had good access to [electronic mail system] terminals; they used [electronic mail] quite extensively. (Sproull and Kiesler 1986)

Other reports have focused on the impact of electronic communications on the *scientific* community (Koch 1989, Lederberg and Uncapher 1988). These often make assumptions about both the technical culture within which such systems will be used and about the "mature electronic environment" that will be available to participants on the network. In their more brilliant manifestations, these visions include not only electronic mail, but also multi-media support for collaboration and coordination of work, commenting and authoring tools, decision support systems, computer conferenceing and, of course, any necessary infrastructural support (Lederberg and Uncapher). While these visions may be realizable on a small scale, they will not serve a diverse academic community well (Ruhleder and King 1991).

These settings differ considerably from the kinds of setting in which academics in humanistic disciplines might use electronic mail. Theirs is a community with, first of all, far less funding than the sciences, and whose individual members may not have ready access to electronic mail, nor work in an environment where others with whom they communicate are available electronically. Nevertheless, some findings or expectations do carry over into the humanities. We shall examine these shortly.

Why *Not* Use Electronic Mail?

Given the above brief survey, it would seem that electronic mail presents users with extensive new opportunities for communication with friends and colleagues, and obtaining information from a diverse set of sources. Why, then, is electronic mail still such an underutilized technology among classicists?

The limited use of electronic mail can be attributed to a variety of factors. First, while individuals in the computer sciences or engineering might take electronic mail for granted, it isn't always as easily accessible to members of other departments on campus. Sometimes there are physical constraints, such as older buildings that can't easily accommodate additional wiring for terminals and communication lines (Richardson, Harvard). Then there is the cost: the hardware (such as a terminal or modem) must be purchased, a burden which often falls on the shoulders of individual faculty members; and accounts on the local mainframe usually cost some kind of "money," even if it is artificially created money. Both kinds of costs put a strain on resource-poor departments or individuals. There is a convenience factor involved, as it becomes cumbersome to log in and check mail if the equipment to do so is not located near at hand— and disappointing to go through the effort of logging in and finding an empty "mailbox" because so few of one's colleagues are "on the net." And, finally, there is that nagging factor of expertise again. Learning to use electronic mail means learning to use a mainframe and mail program, or to connect a modem and some kind of interface.[8]

The limited use of electronic mail within the classics community precludes asking certain kinds of questions. To assess the impact of electronic mail on inter-departmental communication would be virtually impossible, since it is unlikely that one would find a department with enough members "on-line" to make such a study feasible (though a potential counterexample is included below). It also makes it difficult to study the impact of electronic mail on collaborative efforts, as it is unlikely that all members involved in a given project will have access to or use electronic mail. However, even given these constraints, we can begin to draw

[8]One of my favorite comments about e-mail was made by an informant in a face-to-face interview: "I think you had a BITNET number or something on your letter, some funny little symbols at the bottom." He was refering to the internet address I had included in my letter requesting the interview. This sums up so neatly many classicists' attitudes towards electronic mail and computing in general: quaint, funny, but hardly a part of their daily lives.

some conclusions about the impacts, current or potential, of electronic mail on classics and on the Humanities in general.

Before moving on to a more detailed discussion of electronic mail and its impact on scholarly work, let me share the example mentioned above, found in the classics department of a small, private college. The department had recently installed a local area network for inter-departmental electronic mail. One faculty member comments,

> At first I said, "Why would we want to send something via e-mail when the phone is right there?" I've had to eat my words. It's fantastic for communication with professors and secretaries. You can read stuff at your leisure. If it's important, you can use Broadcast [to send a message to every member on the department network]. I administrate the Masters of Theology program. You have things all of the faculty need to know, you can send these via e-mail. It saves paper, you can even attach a file. I take the faculty minutes, which I write up on the computer, put on the server. They are sent to the secretary to "proof," sent on to the dean for changes, back to the secretary for printing. The process is streamlined. The secretary would like it better, probably, if I were to bring down the paper to her in person. (Biblical Scholar)

Such an arrangement is still the exception, not the rule. However, this excerpt demonstrates some of the potential, and also highlights the role of campus administrators. In this example, the dean of the School of Theology not only had the system installed, but insisted on its use by refusing to accept paper documents in certain situations (such as the transmission of the minutes described above). In this instance, the mail system has gone beyond the utilitarian; the faculty member quoted above added, "There's lots of tomfoolishness that goes on with e-mail, broadcast."

Electronic Mail and Personal Communication

With caveats and exceptions out of the way, let us turn out attention to the more standard uses of electronic mail that we find within the classics community, and how it effects its members. Classicists use electronic mail in a variety of ways, and with a variety of attitudes towards the medium. Comments about electronic mail range from the positive,

> I make extensive use of e-mail. This has enabled me to carry on very active interchanges with scholars. (Gerson 25-4-90)

to the negative,

> Electronic mail has so far *not* increased my contact with other classicists significantly .... It has occasionally been of use in producing a quick answer or

> notifying me of a useful bit of information; more generally it has been a colossal waste of time reading matters of no particular interest to me— producing a "mailbox" with fifty items of junk mail a week. (Israeli Classicist)

Both of the above statements were made by "computer literate" individuals and subscribers to the Humanist mailing list (from whence stem, no doubt, the "fifty items of junk mail" mentioned in the second quotation).[9]

Most communications within the scholarly community still take place using the telephone or standard surface mail: "you phone people, you send stuff" (Papyrologist). The postal system supports a variety of forms of communication. At some point, I sent a request for an interview to a member of a Classics Department who was out of town at the time I would be at his university. He neither telephoned me nor contacted me electronically, but sent me a hand-written note explaining his absence and providing me with some information about his involvement with computing. We have since exchanged a series of letters— mine written using a word-processing program and printed out on a laser printer, his manually written in a small and regular hand. Classicists use standard surface mail to send drafts to colleagues; to receive updates, proof sheets and finished books from publishers; or, as mentioned in another chapter, to write to the TLG with search requests, the results of which are then mailed back to the requestor. Sometimes this is due to *technical* limitations; several individuals who use electronic mail cite the inability of their systems to handle long files (noted by some of my electronic informants).

As an instrument for supporting more spontaneous and more interactive communication between individuals, the telephone has probably made a greater impact so far than electronic mail will for years to come.

> The telephone, now that's an interesting piece of technology. I used to be the editor of a journal; I spent hours on the phone with other editors. For example, I'm going to take part in a conference call this week to discuss ninety papers for a conference, trying to decide on the program. I'll be talking to someone [on the other coast], and some others that I don't know about. (Papyrologist)

Often, communicating electronically with colleagues is simply not an option at this point: "no, [I don't use it for discussing interpretations], because so far there's not that many people that are on this type of [electronic] network" (Hellenist). Another says, "my response to the problems in my own work is to call people up and say, you know, what do you think about this ..." (Hellenist). The people he would exchange ideas with or share drafts with are, again, not "on line." Some of them may deliberately shun electronic mail, adopting a "wait-and-see" attitude.

> I suppose, if everyone were connected ...; I guess I am one of these people who suspects that a certain amount of what has happened is just ... hype. I don't

[9] As the proverb says, "One man's meat is another man's poison."

> know, it's just taking more effort than it's worth. ... I'd rather not, you know, become an engineer or something. [I think we] have to go as a profession through a period like that, figuring out what can be done, and I've pretty consciously decided to sit back and wait for other people to do that. (Classicist)

When members *are* available electronically, it can facilitate both admistrative and collegial communication. A West Coast classicist cites three examples:

> (1) Last year, I was going to be at the [American Philological Association] convention, [and an East Coast colleague] was going to be at the convention, and we arranged to have breakfast together.
>
> (2) And one of my colleagues sent e-mail to me from Oxford [where she was a visitor]: "I can't find this, can you look in my office for that?"
>
> (3) A visiting professor is in Israel; she sent e-mail to me; she had me do a search for her last month, a word that was used by late Roman authors. One of the Greek authors of the Roman period. And I was able to find all the instances. I put them in a file and sent them to her. (Classicist)

Again, most of his communication still takes place via standard letters, surface mail, and the telephone. Learning to electronic mail often takes place in the same way as learning to use other forms of computing: through individuals helping other individuals, and through personal initiative. "Another faculty member got me started on e-mail. The rest I learned myself. Since I was the first computer user in my Department, I then trained the entire Department in computer use" (Classicist).

As e-mail becomes more prevalent, tasks now carried out using mail or telephones may be shifted to the new electronic medium.

> As an editor [for a journal pertaining to an English Renaissance writer] ... I am in touch daily through electronic mail with my two principal readers for [the journal]. (Renaissance Scholar)

An assistant uses the computer to handle subscriptions, log manuscripts, and so forth. Electronic mail especially makes it easier to communicate with individuals in different time zones, especially those literally on the other side of the globe. And it allows for spontanous and asynchronous communication: "Now you might not bother to write a letter, you might not bother to pick up the phone and talk to the person about it, they might not be in their office, the hours are different on the East Coast, but if it's just a matter of typing e-mail and wait for it to come back ..." (Classicist). Others use it to communicate with European colleagues.

The availability of electronic mail can also make it easier to communicate with individuals *outside* of the classics community:

> I have used it on campus, to show drafts of proposals when we were developing the databank; I sent them over to people in computer science, ... [and used e-mail] when we were trying to get the programming help from the specialist to list out what we wanted. (Classicist)

As classicists become more involved with the *technical* communities, and as individuals such as humanities computer consultants begin to bridge the gap between humanists and the technical world, electronic mail may well help speed and ease this process.

Some tool building projects, such as the TLG at UC Irvine, the Perseus Project at Harvard, and the Greek inscription project at the University of Michigan, are "on-line"; others, such as the Packard Humanities Institute and the papyrology project at Duke University are not! Electronic communication can take place between projects, or between staff members and individuals within the acacemic community interested in using or contributing to the project itself. This can facilitate dialogue with the user community. For one user of a PC-based search program for use with the TLG's CD ROM, located in Canada, contact with the developer, located in Texas, has been entirely electronic. He is quite happy with the arrangement: "The manual is pretty good, and [the developer] is accessible by e-mail" (Canadian Classicist).[10]

Others outside of classics have turned or are turning to electronic mail to coordinate and communicate about larger projects.

> The members of the group [working on a commentary for a medieval English text] are at five different universities; we won't finish the project in [the six months there were in residence at the host university]. We hope to have enough money and know-how to get connected. We can then put our own work directly into the machine. This can include sending new notes electronically using e-mail, connected via phone. (Medievalist)
>
> I also use electronic mail extensively to correspond with scholars working on similar projects, especially in the U.K. (Renaissance Scholar)

Finally, as a sign of the changing times, the *American Philological Association* now keeps a directory of members' electronic mail addresses— 61 members registered their addresses in 1989, though this list was not all-inclusive. Last year, in 1989, these members received materials about the annual meeting electronically as well as in their physical mailboxes (Classicist).

The availability of electronic mail and the viability of electronic networks, of course, is often tightly coupled to events far outside the scope of a single department, or even the discipline as a whole. Consider the following comment of a classicist on the changing political face of Europe:

[10] An Israeli classicist has had less luck with an Italian developer.

> Our ignorance of eastern European Renaissances (here is the place to praise Matthias Corvinus Hunyadi, fifteenth century king of Hungary and creator of an astonishing library of precious manuscripts: there is a volume of facsimiles of selected pages edited by two persons named Csapodi, I believe, and well worth a half hour in the library turning the pages) is in part a reflection of the long Stalinist darkness in the east. ... As our e[lectronic]-links to the east begin to open, it is pleasant to think that in restoring the central and eastern Europe of the present to the European community, it may also be possible to restore more of its past. (Classicst)

A recent issue of *Reach*[11] (January/February 1991) held out hope that these links would soon be established: it announced a discussion group on Hungarian issues [12] and the establishment of electronic mail connections with three Hungarian universities: Budapest Technical University, Budapest University of Economic Sciences, and Eötvös Loránd University.[13]

Currently, scholars tend to communicate with individuals in the department about administrative matters, but often correspond with others outside of the department on questions relating to their research. Sometimes visitor provide such contact, "... when a scholar would pass through, I'd say, 'you know, I'm working on the way Euripides uses Pindar' " (Hellenist). Other times, contact is established at conferences and meetings. This is especially true for those who represent some specialty: "There is a tri-ennial congress for papyrologists. ... You tend to be a loner as a papyrologist because there's usually only one of you in a department," and rely on established contacts with other papyrologist when sending out drafts of papers (Papyrologist). Some classicists in smaller teaching colleges may even be the only *classicist* on faculty. For these individuals, contact with the "outside world," specifically other scholars in their discipline, is essential. Electronic communications can facilitate this contact, particularly for those located in rural or remote areas. As electronic groups such as the Hungarian issues group and one-to-one electronic mail becomes more prevalent, we may watch with great interest to see if there are changes in traditional patterns of communication. We may also watch to see if they alter the role that visitors and conferences play in providing initial and on-going contacts among individuals with a particular research focus or set of interests.

As this variety of responses demonstrates, electronic mail is still in its infancy as far as the classics community is concerned, and more traditional forms of communication are still the prefered means of communication. The reasons are many: cost, ignorance, disinterest, and

[11] *Research & Educational Applications of Computers in the Humanities*, a newsletter published by the Humanities Computing Facility of the University of California at Santa Barbara, described in an earlier chapter.

[12] The group and list server addresses are, respectively, *hungary@ucsbvm.bitnet, and listserv@ucsbvm.bitnet.*

[13] Certainly technical advances alone cannot overcome political or organizational barriers, but they can certainly facilitate individuals in their subversion. Recall the use of fax machines on the part of Chinese students during the 1989 student uprisings in Mainland China, and "ham radio" operators who have long been in touch with counterparts behind the "iron curtain."

more. Many of these factors are linked to the lack of a "critical mass" to drive the innovation process forward. Why overcome the barriers when the payoff in terms of communications opportunities are few? Only time will tell whether or not established patterns will change; however, it is fairly likely that electronic communications will play an increasingly important role in the classics community. One particular vehicle for "joining" the community, addressed briefly above, is the *electronic mailing list.* A variety of mailing lists and other on-line forums are discussed in more detail below.

7.1.5 Emerging Electronic Communities

> The new electronic interdependence recreates the world in the image of a global village.
>
> — Marshall McLuhan, *The Medium is the Massage*

While personal communication via e-mail is only slowly becoming more prevalent, one important feature of the emerging "electronic community" is the *mailing list.* Barlow (1990) describes electronic bulletin boards and mailing lists as "...the latest thing in frontier villages. ...Town meetings are continuous and discussions rage on everything from sexual kinks to depreciation schedules." Electronic mailing lists form around more traditional issues such as post-modernism, while yet others are geared towards technical issues such as specific tools or software packages.

Membership in these groups, however loosely organized, alters networks for information exchange and changes the set of people with whom one is most likely to interact. One particularly important mailing list within the larger community of scholars in the Humanities is aptly named *Humanist.* This mailing list connects the scholar with other scholars of whom she can ask research-related questions. It also connects the scholar with those who can provide *technical* advice, thus serving as a forum for developing a communal technical expertise. It is "an international electronic discussion group for computing humanists and for those who support the application of computers to scholarship in the humanities," and is affiliated with the Association for Computers and the Humanities and the Association for Literary and Linguistic Computing (McCarty 1989).[14] At the time that statement was written (March 25, 1989), Humanist consisted of over four hundred members in seventeen countries in North America, Europe, and the Near and Far East. As for its content, "equally relevant are technical questions about hardware and software, specific problems in humanistic scholarship, and both the administrative difficulties and philosophical issues arising from

[14]Information about the Humanist mailing list is drawn from (McCarty 1989); interviews with one of the current co-editors of the list, Elaine Brennan; and discussions about the list occuring on Humanist itself. When refering to discussions on the list, I will include the date, the volume, and the number of the message. Individuals interested in retrieving old submissions from or subscribing to the list should contact editors Elaine Brennan and Allen Renear electronically at *editors@brownvm.brown.edu* or write to the editors at: Humanist Editors c/o Allen Renear, Box 1885 / CIS, Brown University, Providence, RI 02912; 401-863-7312.

the application of computing to the humanities" (McCarty 1989). The *lingua franca* of discussion is English. Consistent with the description of the mailing list, a typical day's mailing (Monday, September 10, 1990; v. 4 ns. 465–467) included: a criticism of one university's decision to drop the language requirement; a request for information about low-cost dictionaries available for microcomputers; a plea for help in locating the source of a quotation; and a response to a query about hypertext. Members of Humanist have referred to it as an "electronic hallway."

Humanist is neither an electronic bulletin board nor a conferencing system, and all members normally receive contributions within twenty-four hours of their submission to the editor. Submissions to the list are collected and reviewd by the editor, then sent out grouped according to topic with an appropriate "subject line" for each collection of messages.[15] Censorship is a rare thing, though within the perogative of the editor.

> Normally the editor publishes contributions without altering them .... However, when in his judgment a contribution is incompetent, offensive, or clearly outside the scope of Humanist, he reserves the right not to publish it. Humanist thus lives in the balance between free-wheeling discussion on the one hand and decorum on the other. (McCarty 1989).

Editors may also suggest desisting or continuing the discussion privately to participants when a discussion is getting too limited (with repeated postings from only two or three participants), when the discussion becomes too personal, or when other issues such as potential copyright violations might be concerned.

A set of biographies reveals members to be a diverse group: a specialist in medieval Slavic texts and in Slavic accentology; a graduate student in Computer Sciences interested in issues in human-computer interaction; the editor of an academic press; and, of course, classical scholars. Most members of the list are on the faculty of an academic departments in traditional "humanistic" disciplines such as English or philosophy. It is difficult to know exactly how many people read Humanist on a regular basis. In an earlier report on Humanist, "published" via the list in 1988, Burnard discovered that, over a six month period, 500 out of 600 messages were sent by just eight people, and out of 180 subscribers,[16] 107 sent no messages at all (Burnard 1988a). Half a year later, this trend was beginning to slow, with

[15]One collection, for instance, grouped four messages concerning death and the loss of a name (Brennan 1990). One message discussed the custom of the Benedictine monks of passing down a name, upon the death of a monk, to one newly taking religious vows. Another message refers to the Chinese custom of making the characters in an emperor's name taboo after his death.

[16]As of its fourth "birthday," May 7, 1991, the Humanist mailing list boasted 1,050 subscribers, over twenty of which were bulletin board systems. The editors estimated a readership of over 2,000. In an interesting example of anthropomorphism, the message from the editors to the *Humanist* list read: "On May 7 1987 (sic) our list was born. In those early family years the birthdays came slowly and with much celebration. Her wonderful beginnings were fondly analyzed and proudly chronicled by her family. Now as she stalks her large and wayward way about the wide world the years seem to rush by" (v. 4, n. 1325, Tuesday, 7 May 1991).

a more even distribution of contributions, though a small core of individuals still dominates the list (Burnard 1988b). Some follow particular discussions, a practice facilitated by the inclusion of subject headers. One classicist who has prepared several electronic texts for personal use and for sharing with a small group of colleagues follows a sporadic dialogue on digitizing and encoding. Yet even those who only follow Humanist intermittently or focus only on particular dialogues expand the number and range of colleagues to whom they can turn for help or advice, and the kinds of information with which they may come in contact serendipitously by participating in the electronic dialogue.

7.2 Humanities Computing: Brave New World?

> The open society, the unrestricted access to knowledge, the unplanned and uninhibited association of men for its furtherance— these are what may make a vast, complex, ever growing, ever changing, ever more specialized and expert technological world, nevertheless a world of human community.
>
> — J. Robert Oppenheimer, *Science and the Common Understanding*

In many of the above examples, the individuals involved were engaged in expanding their abilities to carry out traditional research tasks. Electronic communications offered them another way of gaining access to materials, information, and the advice and feedback of colleagues. In some cases, this was achieved by a single scholar gathering information from a remote databank (such as an on-line card catalogue system containing holding for libraries located at other universities). In other cases, this meant that scholars were more easily able or more likely to communicate with individuals in other departments or at other universities, either on a one-to-one basis or as members of a larger forum around shared interests. Often, however, neither the impetus for nor the *content* of information acquisition or exchange strayed from traditional lines. If, instead, we allow our vision to embrace members of the broader humanistic community as well, we may be able to apprehend a movement towards the development of a new community of interest centered around humanities computing.

7.2.1 Streams of Interest

What exactly does "Computing and the Humanities" mean? The general interest in humanities computing comes in a number of often overlapping "flavors." In a recent volume entitled *Humanities and the Computer: New Directions*, editor David S. Miall (1990) outlines the guiding principles behind the volume as follows:

> The primary purpose of this book is to examine the role of computers in the Humanities, with a predominant focus on new developments in higher education. But a number of issues beyond those involved in teaching and learning are also discussed: these range from the current situation of higher education (university management, funding, the relation of teaching and research) to the models of the mind which lie behind the increasing use of computers in the Humanities. ... In tracing here the high ground of the arguments that the authors present in their various chapters, I hope to highlight not only the significant role that computers are destined to play in the Humanities, but also the role that the Humanities can play in the development of computing.

Drawing on this statement and on the contents of a number of other sources (eg., Bailey 1981, Burton and Short 1983, Hirschheim and others 1990, Rahtz 1987), I identify the following kinds of work interests surfacing under the rubric, "computing and the Humanities."

- *Development of educational tools.* Without doubt, this has been one of *the* major streams of work in humanities computing. While earlier efforts often focused on systems to help students with rote memorization or drill-and-practice tasks, more sophisticated projects are underway. These include multi-media hypertext systems such as *Perseus*, discussed in an earlier chapter (Hughes 1986), or campus-wide networks such as MIT's *Project Athena* (Lerman 1984). Many educational tools are designed to support a specific area, such as archaeology (Walsh 1981). New approaches involved the application of techniques from artificial intelligence to develop more sophisticated teaching tools (eg., Farghaly 1989).
- *Creation of an institutional framework for supporting humanities computing.* Campus computing strategy is an issue which appears both in on-line forums such as *Humanist* and in the literature (Davidson 1984, Emery 1984, McCredie 1984, Updegrove 1986). Discussions range from the technical (which kind of hardware or software to get) to the organizational (how to allocate funding for computing projects, what databases to support, whether to support networking on/off campus, who decides on academic computing issues).
- *Creation and access of machine-readable texts.* As mentioned in an earlier chapter, this was one of the first kinds of humanities computing efforts. The development of the TLG and the Oxford Concordance Package fit into this category. Current projects include not only continued efforts to prepare and distribute more texts in electronic form, but also the development of a standard text markup language through mechanisms such as the Text Encoding Initiative (discussed in more detail in the following chapter).
- *Statistical analysis of texts.* Another early venue for humanities computing was the statistical study of linguistic or textual features (eg., Yule 1968). Scholars combine techniques of statistical analysis with texts available in machine readable form to address issues of vocabulary studies, morphological and syntactical analysis, stylistic studies, and authorship studies. Morton (1978) has been particularly influential in this area.

- *The application of computing tools to answering traditional research questions.* This includes the use of software to support specific research tasks, such as textual criticism (Hockey 1980). These may include obtaining sources, using the computer to store and sort notes, writing and editing using word processors, communicating with colleagues and journal editors electronically. This dissertation has addressed a number of these issues; Kren and Christakes (1988) a fairly comprehensive guide to microcomputing in the humanities and social sciences.
- *Self-analysis and redefinition.* Some seek to address the broader ramifications of computing in the humanities. These include reflective pieces from within the humanistic disciplines that attempt to reassess the role of computing in the humanities, and, conversely, the role of the humanities in a technological age (Angotti 1990, Bantz 1990, Ennals 1987). They may also address more narrow concerns, such as the change in the quality of writing given word processors, hypertext, or access to on-line databanks (Heim 1987, Martlew 1990, Teichman and Poris 1989).
- *Analysis of technological impact from a humanistic perspective.* Individuals who are members of humanistic disciplines bring the techniques of their own discipline to bear on social/technological issues. Philosophers might address the ethical issues in perinatal medicine (Westra 1990), and English professors might discussed the ironic use of motor vehicles in the works of Robert Cormier (Wess 1990) or use science fiction novels to call attention to paradigms of human-computer interaction (Sullivan 1983).
- *Social and organizational studies of technological impact.* They also include work which seeks to explore the impact of computing technologies on a particular field within the humanities, or on the humanistic disciplines in general, from social or organizational perspectives (Hirschheim 1990 and this dissertation).

Note that these few categories do not by any means capture *all* the kinds of work being carried out. There are programs for merging various text files for textual criticism; studies in machine translation (Warren 1990); automated marking of sound patterns in Latin, and other applications (Hockey 1980). These, however, give the reader a fairly concise overview of the different areas of interest that fall, at various times, under the more general heading of "computers and humanities."

Individuals with interests in humanities computing are generally also located within some "home" discipline, be that classics, English, or computer science. At some point, they develop an interest in humanities computing, and begin to devote some amount of time to this new area. Certainly *Humanist*, discussed above, offer one vehicle for developing a sense community and ties with other like-minded folks. Another vehicle for developing a sense of cohesion is the Association for Computing in the Humanities (ACH). This organization publishes a newsletter and is linked to a journal, *Computing in the Humanities*

(CHum).[17] It holds a yearly conference, which is a joint conference with another organization, the Association for Literary and Linguistic Computing (ALLC). The ALLC also publishes a journal and bulletin. The work published in these journals centers heavily on statistical computing. However, other areas and interests are also addressed in articles, book reviews, and software reviews; for instance, one recent issue of the journal, *Computing in the Humanities*, was entirely devoted to intelligent computer-assisted language instruction (v. 23, n. 1, January 1989).

Certainly the two major streams of research fall along the lines of educational computing within the humanities, and statistical analyses of language and texts. The larger "oases" for computing humanists, the ACH and ALLC, are joined by a host of smaller groups, such as one at Brown University which meets bi-weekly, or *Bits and Bytes Review*, which covers software and hardware products, projects such as the TLG or Perseus, fonts for Hebrew, and other more or less technical subjects. There is a Computer Users Group convening at the 1990 annual meeting of the American Philological Association, as well as a scheduled meeting of the Committee on Computer Activities. These smaller groups, sometimes located within a "home" discipline and sometimes cutting across the humanities, tend to support users with very specific interests and needs.[18]

The two areas of research clearly not represented are the two final "interest areas" on the list presented earlier: analyses of technological impact from a humanistic perspective, and social and organizational studies of technological impact. The former are absent from these forums, and are much more likely to address questions which "belong" within established disciplines and subdisciplines such as philosophy or English literature (Kristin Shrader-Frechette, for instance, spoke one day at the 1990 *Humanities and Technology Association's* conference, *INTERFACE*, the next day at the conference of the *Philosophy of Science Association*).[19] Social and organizational analyses of technology, similarly, are part of other streams of work located in computer science, the social sciences, and management sciences; and published in journals located within these disciplines.

[17]Both the ACH and CHum were established in 1966 by Joseph Raben of Queens College, New York, and on the basis of this historical link the journal had always been distributed to members of the ACH. As of 1989, two years after Glyn Holmes of Western Ontario assumed the editorship, this link was formalized (Holmes 1989).

[18]Just as an aside, and to highlight an interesting feature the community which forms the membership/readership of the ACH/CHum, let's turn to the two special issues on activities in France (October–December and July–September 1986). Many submissions are in French, including one which analyzes features of the German language. The latter volume also contains a review of a book written in French which itself is written in German by a scholar in Hamburg. Mind you that this journal is edited by and primarily distributed to an English-speaking community. In a previous issue (April–June 1987), reviews in English of French and Italian books appeared. Could we ever expect such linguistic diversity between the pages of *Communication of the ACM*, the primary journal of the *Association for Computing Machinery*? I think not.

[19]And the names won't necessarily help, at least at first glance. Note, however, the subtle linguistic difference between where the tool developers hang out (*Association for Computing* **in** *the Humanities*) vs. where the "pure philosophers" hang out (*Humanities* **and** *Technology Association*).

In the introduction to his book, Miall (1990) asks whether humanities computing is itself emerging as a new discipline. He answers in the negative, citing the lack of a newly emerging framework for method or interpretation of work in the humanities. Yet, a certificate program in humanities computing for graduate students was recently established at the *Centre for Computing in the Humanities* at the University of Toronto.[20] This would suggest that formal, institutional recognition of this new area— fuzzy as it may be— is slowly being established. The courses, one covering instructional methods by computer, the other covering basic research methods by computer, are to be taught by lecturers from a variety of departments including not only English, history, Slavic studies, philosophy, linguistics; but also pharmacology, industrial engineering, management studies, and library science.

At this point, however, humanities computing it is at best seen as a useful set of skills that help a student/scholar do "real work"; at worse, it is considered something vaguely unimportant, to be learned in one's spare time. At this point, though there are clearly shared areas of interest or concern, and shared forums in which these are expressed and debated, "humanities computing" as a whole seems to lack a coherent focus or a joint vision. It is still often almost more defined by what it is *not* (traditional "X") than by what it *is*. At this point, however, it is probably too early to make any conclusive statements as for many humanists, the advent of the computer and its applications to problems in research and teaching took place just a few years ago. However, as an area of interest with members following a number of streams of research, it will surely continue to grow in strengh and its branches may develop into flourishing social worlds in their own right.

7.3 Summary

In this chapter, we have looked at some of the current and potential future impacts of electronic comm unications within classics, and within the humanities in general. The reader is cautioned to remember that these are not the results of a survey; they are not "statistically significant." For instance, if a survey were to be taken today, the majority of classicists would not be active users of electronic mail. However, a small and growing contingent *does* incorporate electronic communications into their daily patterns, and through them and through the activities of other Humanists we can observe the kinds of changes this is making in their work. Other work on the impacts of electronic mail and electronic networks can serve to guide us in making predictions about the future impact of electronic communications on classical scholarship. We can expect the social world within which classicists work to change dramatically over the next few years— certainly within the next decade. As electronic mail becomes more the norm within the community, participation in "electronic

[20]Announced in *Reach* (January/February 1991), with the following contact noted: Willard McCarty, *mccarty@vm.epas.utoronto.ca.*

hallway" conversations such as those on Humanist will become more prevalent. Meanwhile, the movement to incorporate computing into the humanities at all levels will continue to gather strength and proponents, perhaps leading to the emergence of new social worlds.

Chapter 8

Social Transformation? Conclusions and Future Directions

> Orderic Vitalis, the English historian of the Normans, says at the end of one of his books (which he penned himself) that he is so numbed by the winter cold that he is going to finish his book at this point and will relate what he has omitted when the spring returns. (from Clanchy, *From Memory to Written Record*, p. 90.)

Coming at the end of a dissertation, the above quotation can, perhaps, be taken as a sign of the writer's (my) weariness. The same quotation, however, can be considered on a multiplicity of levels, which return us to some of the issues raised in the initial chapter about the nature of transformation. First, it raises some important points about the *material* world within which the scholar functions and the ways in which a shift in that material world affects the work process. The introduction of information technologies into classics surely constitutes a change of that material world, which I consider in more detail below.

The quotation also raises an important point about the nature of academic work. The idea of "doneness" in academic work is closely linked to the role of the individual in the Academy. Just as Oderic Vitalis vows to continue his history in the Spring, one is never "done" with one's work; at most, one brings to a close one particular study, article, book, or course. The ideal of the Academy, however, requires that this product feed into the next and the next in an on-going chain of intellectual interdependence. This point will be dealt with more extensively in the section on future work and the dimensions of collaboration.

Finally, it raises the question of knowing when this particular piece of work is **done**. This dissertation set out to investigate the nature and extent of impact that information technologies are having on one particular world of work: the domain of classical scholarship. In particular, I asked if the introduction of these technologies has served as a catalyst for *social transformation* within this social world. But what exactly constitutes a social transformation, and how does one know when one is done delimiting and measuring that transformation? In this final chapter, I address that question, and consider the potential

scope and duration of social transformation. I re-examine the specific changes occurring in the social world of classical scholarship, and conclude that a transformation *is* occurring within classics, as both dramatic and more modest changes accumulate to re-shape the social world of classical scholars. At the same time, this social world is retaining many of its conventions and traditions, often incorporating them into the new technologies. Finally, I suggest directions and questions for future research by drawing on issues arising out of this investigation.

8.1 Classics and Computerization: Change Observed

> The basic fact of today is the tremendous pace of change in human life.
>
> — Jawaharlal Nehru

Classics is undergoing a variety of changes, each of a different magnitude, duration, and import. Before broaching the question of whether or not a social transformation has occurred (and what that would entail), I wish to recall some of the changes that are happening within the discipline. Drawing on examples from the preceding chapters, I attempt to categorize these changes in a meaningful way.

In earlier chapters we explored various aspects of the social world of classical scholarship, and examined a variety of changes that are taking place as a result of the introduction of new, computer-based information technologies. Let's recall some specific examples before we consider these changes more broadly:

- Instead of writing out a manuscript, then typing it or having it typed by someone else, scholars now directly write and re-write their manuscripts on their word processors.
- With access to electronic databanks, scholars no longer need to rely solely on concordances, indexes, or manual scanning in order to do word searches.
- Humanities computing centers are springing up, and both students and faculty can now take courses in humanities computing.
- Electronic communications are changing the kinds of people scholars are in touch with, and are making it possible for them to form "electronic communities."

Some of these changes (such as the access to texts via electronic databases) affect the kind of questions an individual scholar can easily address, while others (such as electronic mail) affect the relationships between individual scholars and other members of the academic community. We can try to make sense of such a diverse set of changes by grouping them according to shared features. Below we summarize several major *kinds* of changes illustrated in more detail in earlier chapters. Each of these affects the scholar both as an individual and

as a member of a larger community or multiple communities. Of course, these different kind of changes are not mutually exclusive; the emergence of new research interests, for example, may be intricately linked with a redefinition of the image of classics and may lead to a shift in the infrastructure supporting scholarly work.

8.1.1 Changes in *Process*: New Divisions of Labor

One of the fundamental activities of classicists is the production and dissemination of books and articles detailing research results or conclusions. With the spread of personal computing, both the flow of work and the division of labor which contribute to the preparation of academic manuscripts have changed. Before the advent of the personal computer/word processor, scholars would first write out their manuscripts long-hand and then type them or have them typed. Revisions would be written into the margins, or new sections penned long-hand, then a new version would be typed. When special alphabets (such as Greek or Hebrew) were called for, a different typewriter[1] would be required. Eventually, the manuscript would be proofread carefully and mailed to the editor of a journal or academic press. Eventually, a professional typesetter would set the document, then it would be sent back to the author for corrections. The transfer of materials would involve three distinct sets of individuals (scholar, secretary, and publisher) and two distinct sets of interactions (between scholar and secretary while readying the manuscript for submission; and between scholar and publisher for printing and disseminating the manuscript).

The availability of word processing software has changed the division of labor between these individuals and has altered the integration of the various tasks. The tasks of writing/rewriting and typing/copying have been melded into one, and are now carried out by the same individual. The presentation of textual materials in ancient languages has been simplified further with the advent of word processing packages that support special fonts and the ability to directly transfer electronic texts from electronic storage media storage medium into a text file for editing.[2] This not only cuts down on the effort expended in retyping manuscripts, but it eliminates the need for proofreading Greek, Latin, and other quotations with each new version, a task that could only be carried out by someone knowledgeable in the appropriate ancient language.

Similarly, sophisticated word processing and desktop publishing packages allow individual scholars to carry out tasks formerly reserved for publishers, editors and typesetters. In

[1]Or, more recently, a different type ball with the advent of the IBM Selectric and its clones.

[2]The *American Philological Association* and *Scholar's Press*, for instance, now offer for sale *Greekkeys*, a Greek-English Word Processing program for the Apple Macintosh Computer. This program offers three Greek fonts (Salamis, Attika and Sparta) in six point sizes (9, 10, 12, 36, 40, and 48), as well as metrical symbols. International versions with all system commands in the native language are available for Denmark, France, Germany, Greece, Italy, Switzerland and the UK.

theory, authors can now submit "camera-ready" copy, formatted to the publisher's specifications, via electronic mail or on diskette. By doing more of the work themselves, scholars gain a great deal of control over the presentation of their work, especially when the work is of a complex nature (requiring extensive and detailed charting, for example). It can also cut the cost of publishing as it obviates the need for expensive typesetting services, and should also help speed up the publication process, as it eliminates several steps (and individuals) from the publishing process.

8.1.2 Changes in *Access*: Re-Packaging for Democratization?

A prerequisite for the production of manuscripts, of course, is the research itself. For classicists, especially literary scholars, the requisite "data" is textual in nature. Information technologies provide both *more* and *less* access to the traditional kinds of textual data used in literary scholarship. Scholars were traditionally limited by readily available editions and by their ability to obtain texts through channels such as book sellers and libraries. This is no longer the case. Today, classicists are able to gain direct access electronically to a wide range of texts. With a personal computer and a CD ROM and ROM reader, a scholar can have access to *all* of Greek literature via the *Thesaurus Linguae Graecae* (TLG). The TLG CD ROM includes rare and out-of-print works, and works that lay "forgotten" in private libraries and archives for years until they were included in the TLG databank. Furthermore, on-line search programs coupled with these databanks allow scholars to carry out complex search tasks not possible using older tools. Software packages for the creation of computer concordances, such as the *Oxford Concordance Package* allow individual scholars to quickly and easily compile a KWIK paper concordance for their own use.

Easy access to a broader set of information tends to democratize information access: the tyranny of the library has been lifted. It may mean, for example, that junior colleagues can compete more effectively with senior colleagues in the field, as databanks can help those newer to the field compensate somewhat for the extensive knowledge more established scholars have gained through working with texts and critical materials over many years. Of course, "more" or "faster" does not necessarily mean better, and some scholars assert that, without personally reading and knowing the texts, one cannot make an interesting or definitive statement about them.

At the same time, certain kinds of information are no longer as readily available. In particular, the traditional *apparatus criticus* and concordance already had embedded in them a good deal of scholarly judgment and critical decision-making. They provided the "user" of the text and tool with much more information *about* the text than pure-text on-line versions now provide. This information is, of course, still available via traditional sources (textual editions and paper concordances in the library). However, the information is not readily

available in electronic form and, in the case of the apparatus criticus, is no longer coupled with the text.

8.1.3 Changes in *Materials*: From Paper to Electronics

The change in process and access are directly linked to change in the "material world" of the classicist. This material world has been distinctly altered by the advent of information technologies, which have opened up new opportunities for the storage, transmission, and manipulation of text. Some of the future possibilities these new technologies offer will be discussed below. Others, however, are obviously at hand already, and visible by merely walking into the office of a faculty member who is an active computer user. Yes, there are still book-lined shelves against the wall, but there is also a computer prominently placed on a conveniently accessible work surface. Next to the books and papers one might expect to find are boxes of diskettes and computer print-outs with the results of word searches. These cost money, take up space and, as Kling and Scacchi (1982) illustrate, their optimal use is predicated on the availability of "skilled staff and good operations procedures, as well as physical systems such as reliable 'clean' electrical energy and low-noise communication lines." Some older buildings even lack the latter. These changes in the material world of the classicist have led to a parallel set of changes in the kinds of technical and organizational infrastructures required to support classical scholarship. They also require new forms of expertise in order for the classicist to successfully manipulate this new material world. Both of these aspects are discussed below.

One consideration to keep in mind in classics is the variety of technologies in use and their sophistication. Consider the following comment with respect to a standard generalized markup language (SGML) for text encoding:

> Because it tries to anticipate all possible uses of electronic texts, SGML ... is quite cumbersome. However, the great virtue of SGML is that it is largely hardware-independent. Not all of us can afford (or have supplied to us!) state-of-the-art hardware. Alternative standard markup proposals will need to recognize how important "backward compatibility" has been at a time when a computer "generation" lasts 5 years or less. (George Aichele on *Humanist*, v. 4, n. 588; Monday, October 15, 1990)

This point is an important one, and should be kept in mind when considering the development of expertise and organizational/technical infrastructures in a material world that is changing at a rapid and non-uniform pace.

8.1.4 Changes in *Expertise*: Learning New Tricks

Classical scholars are already experts in their own field. They read at least two ancient languages— Greek and Latin, and possibly also Hebrew— and three modern languages— English, French and German. Now, in order to remain "competitive," they must develop a completely different type of expertise, a *technical* expertise that allows them to effectively and efficiently apply computing technologies to their work. Today's scholar relies or will soon rely on personal computers, electronic mail, databanks, CD ROMs, and other information technologies at a variety of levels to carry out daily activities. But the skills to do so effectively are rarely if ever a part of the humanities curriculum either at an undergraduate or graduate level. In order to learn to use new tools effectively, scholars rely on personal initiative or on a local community of expertise for technical information.

Consider the redistribution of work and the attendant acquisition of new expertise required of scholars scholars who wish to use word processing and electronic publishing tools effectively. In cases where publishers require electronic submissions to conform to a specific format, the scholar must go beyond the basics of word processing and learn to convert materials from one electronic form to another. An expansion of the infrastructure available to the scholar can help provide or substitute for new forms of requisite expertise, just as electronic communities can form the basis for the development of communal or shared expertise.

8.1.5 Changes in *Infrastructure*: New Requirements

As the *way* in which scholars carry out their work and the *tools* they use to do so change, so does the *context* within which they work. As stated above, changes in the material world of the scholar affect the traditional technical and organizational infrastructures required to support that work. These changes will come at several levels within established academic institutions. As computing becomes a more integral part of scholarly work, expectations about support for this work will change dramatically. Individuals will no longer be interested just in a university's library, but in the level of computing support; the presence or absence of a humanities computing facility will affect the viability of doing certain kinds of research at a given institution. Computing support will not only include access to personal computers and electronic databanks, but access to electronic mail networks. In order to provide this support, budgets will have to be reconfigured at a variety of administrative levels. Individual departments have already made decisions to draw on travel or library budgets to support computing resources.

Meanwhile, universities are redistributing funds both for the purchase of computing equipment and for the more long-term establishment and growth of humanities computing centers. They are also contributing to the establishment of programs and certificates in

humanities computing, and supporting tool development projects. The TLG at UC Irvine, for example, has recently become recognized as an Irvine Research Unit, a formal distinction entitling the project to specific resources and a specific role within the university structure. At the same time, funding agencies are re-thinking the kinds of projects which they support. Funding for the TLG, for example, comes not only from private sources or the university, but from established sources such as the National Endowment for the Humanities which also continues to support traditional forms of scholarship.

8.1.6 Changes in *Communication*: Electronic Communities

While by no means as prevalent as personal computers or computer-based databanks, the use of electronic communication is becoming more common. These include on-line bulletin boards, mailing lists, and private electronic mail. The content of electronic communications are often still centered along "traditional" lines of interest; for instance, there is a Bitnet list on James Joyce's novel, *Finnegan's Wake*, which was certainly a focus of discussion and research long before the spread of computing within the humanities. Other electronic forums are developing around a new set of computer-related issues. Some of these focus narrowly on a specific technology, such as the *Ibycus* Bitnet mailing list, while others are aimed at a broader community, such as the Bitnet mailing list *Humanist*.

Open, public forums such as mailing lists and bulletin boards serve to expand not only the number but the range of colleagues across a variety of disciplines with whom classicists are in contact. This, in turn, expands the kinds of information with which they come in contact either through directed inquiry or serendipitously, and expands the collegial community to which they turn for both scholarly and technical help and advice. Mailing lists such as *Humanist* are also essential in developing a collective expertise and shared visions of computing. For example, the author of a recent posting[3] requested information about free-form textual databases for storing notes, which he promised to collate and summarize for posting to the list at large.[4]

8.1.7 Changes in *Focal Point*: A New Social World?

For some members of the scholarly community, the computer has become more than just a tool for accomplishing traditional scholarly tasks. Designing computer-based tools to support scholarship *is* for them a task in itself. This new interest may take up part of

[3]David Stuehler at Montclair State College, NJ; Monday, May 6, 1991; v. 4 n. 1322.

[4]The promised summary had not yet been posted by mid-May 1991 when this dissertation was completed and submitted.

their time; for instance, they may develop a small, specialized databank for a particular text or set of texts, or create a new font for informal distribution among a limited number of colleagues and friends. Alternately, this new focus may become the primary or only focus of their work activities. This new focal point of "humanities computing" is reflected in some of the new mailing lists and bulletin boards; I consider the emergence of a new *social world of humanities computing* in more detail below.

8.2 What Ho! Transformation?

> Leaving the old, both worlds at once they view,
> That stand upon the threshold of the new.
>
> — Edmund Waller, *On the Divine Poems*

In the first chapter, I considered a number of "visions" of the kinds of transformations that would take place within our society as a result of new technological possibilities including, but not limited to, the advent of computing technologies. Many of these called for radical revisions of current social and institutional structures, including "new geopolitical relationships, new life-styles and modes of communication," which demand of us "wholly new ideas and analogies, classifications and concepts" (Toffler 1980). By now it is evident that there have been a variety of *changes* in the way that classical scholarship is carried out, in the people involved, even in the questions addressed. But could one say that the discipline has undergone a *social transformation*? Has such a transformation occurred as a result of the introduction of information technologies? In this section, I consider what one might mean by "social transformation," how dramatic or durable the transformation that occurred in classics is, and what further transformation we may expect to see in the future.

8.2.1 The Dialectic of "Social Transformation"

> The future enters into us, in order to transform itself in us, long before it happens.
>
> — Rainer Maria Rilke, *Letters to a Young Poet*

To transform something is "to change markedly [its] form or appearance ... to change the nature, function, or condition."[5] In the case of social or organizational transformation, what would this entail? Such a transformation is often depicted as changes in the nature, function,

[5] *American Heritage Dictionary.* Interestingly enough, the definition of the noun "transformation" incorporates an element of stability. When used within a mathematical or linguistic context, it refers (respectively) to the rotation or mapping of one configuration or expression into another, recoverable by an inverse transformation, or to the process of converting a syntactic construction into a semantically equivalent construction.

structure, relevance, and composition of formal and informal institutions, communication networks, conventions, and values. While there may not always be agreement about outcomes of these "revolutions," the dialectic of transformation tends to center around the direction of change (dystopian vs. utopian visions), rather than questioning the appropriateness of the label, "transformation," or defining explicitly the nature and magnitude of changes worthy of this label.

Tool developers and users in classics often adopt a similar rhetoric with respect to the impact of computer-based research tools. They refer to the computer as a "tremendous catalyst," and specific tools as "part of a revolution in the field" (Tool Developer). The TLG has "within a short number of years, [brought] about revolutionary changes within the field" (Brunner 1988), and "the TLG, and the other tools ... have made certain forms of scholarship obsolete while making others accessible for the first time" (Classicist); the use of databases and computer-aided design technologies in classical archaeology is "revolutionizing our work" (Classical Archaeologist). The nature of these revolutionary changes are rarely stated explicitly, but the implication is that computing opens up new questions and makes the old ones more accessible. Nevertheless, one could argue that no paradigm shift in the Kuhnian sense (Kuhn 1962) has taken place within classical scholarship, and that neither the work that lies at the core of classics changed, nor the methods used to carry out that work have been altered by computing technologies. Indeed, one scholar comments that

> ... the rationale for employing one of these methods in a given subject still comes primarily from the subject, not from the computer. The computer provides a powerful and remarkably versatile instrument for Humanities work, but it does not up to this point provide a way of conceptualizing the Humanities subject itself or the Humanities in general. (Miall 1990, p. 4)

Even the developers of the *Thesaurus Linguae Graecae* could be said to be merely following in the footsteps of the ancients: Callimachus, thought to have headed the Alexandrian library some time during the 3rd century B.C., compiled a bibliographical guide to Greek literature during his long career as learned critic and poet. And yet, the comments and the types of changes elaborated upon earlier in this section indicate that computing has had something more than a minor impact on classical scholarship. Then what rubric can we use to define and recognize a *transformation*?

Work, transformation, and the social worlds perspective. Based on the preceding evidence, I draw the conclusion that we are witnessing a transformation within classics not in the Kuhnian sense of paradigm shift, but as defined with respect to the social worlds perspective. True, some aspects of the social world have remained unaltered. Yet, as we can so clearly see from the above examples, other aspects have change in significant— sometimes even dramatic— ways. New technologies are not only becoming incorporated into the work process, but new organizations and, to a lesser extent, new sites, are becoming relevant to the

production of classical scholarship. Drawing on the features of the social worlds perspective, we can elaborate on these transformations.

To reiterate, a social world exhibits the following characteristics: at least one primary activity is evident, around which shared perspectives arise through participation in common communication channels; these activities occur at specific sites; inherited or innovative modes of carrying out the activities, or a technology, are involved; and organizations evolve to further the activities of the social world. Within social worlds, we may observe the phenomena of segmentation, the tendency for members within social worlds to develop specialized concerns and interests within the larger community of common activities, and intersection, in which a subset of members from two or more distinct social worlds develop a shared set of specialized interests and concerns.

In classics, the primary activity is *literary scholarship*, which occurs at specific sites such as universities, libraries, archives, and similar centers of scholarly research. The technology used to carry out this activity includes physical artifacts such as concordances and etymological dictionaries, and analytical techniques and approaches such as stemmatization and feminist criticism. Finally, organizations have evolved to support literary scholarship in the form of professional associations (such as the American Philological Society), journals, funding agencies, and so forth. On the one hand, we observe a great deal of continuity within the social world of classics: the university structure is still intact, the same journals are still being published, and major funding agencies still give grants for traditional scholarship. Many of the conventions of classics are still shared by the members of the discipline. At the same time, the changes wrought within this social world by computing transform each of the "defining aspects" of the social world of classical scholarship.

While at one level there has been no change in the primary activity (the basic questions about authorship, Roman social structure, et hoc genus omne, are still fair game), there has been a tremendous shift in *how this activity is carried out*— the tasks that compose the work, the materials used in the course of this activity, and the individuals involved in the process. As the technologies used to carry out work become increasingly computer-based, they provide different forms and types of access to information than traditional paper-based tools. This development calls for an emergence of new conventions or an adaptation of old conventions for representing, storing, accessing, and evaluating textual materials. These new technologies are also changing the kind of expertise required of scholars to carry out work.

New organizations have been established to support the application of computer-based technologies in classics. They range from electronic mailing lists to computer users' groups, and from professional associations to conferences. Particularly important is the establishment of new formal or informal organizational structures for developing campus computing policies and funding on-campus computing initiatives at individual and group levels. These organizations form one channel for the emergence of conventions to guide the application of computing technologies to humanistic research. Some conventions are formed through

public debate over questions of appropriate use or text encoding standards; others, such as the TLG's classification scheme, represent a combination of tradition and convention by fiat. Some conventions become codified as standards within the discipline; one such effort, the *Text Encoding Initiative*, is discussed in more detail below.

New sites for the production of classical scholarship are beginning to emerge. Work activity, while still occurring in libraries and individual offices, is increasingly evident in newly-established computing centers. As tool development grows in scope and complexity, the projects where this activity occurs are becoming physically separate entities from classics departments. These sites (at the moment), are still primarily located within the traditional framework of the university; it is unclear what future trends will be.

Finally, we can consider the possible emergence of a new social world, the social world of *humanities computing*. For some individuals, computing has grown in importance from being one of several focal points in their work to forming a primary activity for them and the individuals with whom they interact. Together, they are working to establish standards and guidelines for their work, some of which draw on conventions from more traditional disciplines and some of which are emerging through a dialogue within the social world. Again, work is conducted primarily at centers of scholarly research. The primary technologies is the computer. Organizations are evolving to support these activities. Members from a variety of humanistic (and some technical) disciplines with an abiding interest in humanities computing and tool development are breaking away from their traditional disciplines and joining to forming a new social world.

These changes, striking when considered as a whole, are not always readily apparent.[6] Why are these changes so hard to recognize or understand? The answer is two-fold: first, it is a matter of analytical focus. Again, if one looks at the end results of scholarship, one may not see much if any direct reflection of the changes wrought by computing by canvassing traditional journals in classics. But if one considers *how the work is done* and *who is involved* in the work process, then the evidence for transformation is undeniable. Secondly, these changes are hard to recognize because they often proceeded with such unequal scope and speed throughout the social world of classics. With such a slow and haphazard process of diffusion, recognizable change may consist of a series of smaller changes, each almost invisible in themselves, not visible until this myriad of smaller changes have taken place. I discuss this phenomenon in more detail below.

[6]One recurrent experience in interviewing was that informants would start out by telling me how little (if at all) computing had changed the work of classicists; these same informants would then list in detail the many ways in which they use a computer and the many things they do differently from their pre-computer days. They would then conclude the interview by telling me again that computing had had little impact on their work.

8.2.2 The Dimension of Time: Durable Transformation

> Folly in all of every age we see,
> The only difference lies in the degree.
>
> — Nicolas Boileau-Despréaux, *Satire 4*

Even though change is already underway and apparent, one important question to address is that of *time*. Over how long a period are we measuring change and evaluating the nature of transformation, and how durable or lasting is the transformation itself? Can one determine a fixed "stopping" and "starting" point for a given transformation? Consider the following comment made with respect to the TLG.

> It's a tremendous catalyst, and its impact is still spreading, is still beginning to be felt. And I think that ... the TLG is part of a revolution in the field and ... if in thirty years we have different questions and are able to do things differently and the field really changes over a generation, that's an explosion. ... if you can perceive impact over a course of five years, that extrapolates, it's tremendous. But people don't always realize it, they focus on the short term. They say, "it doesn't work today," or "nothing's happened in six months," or "look at disk drives, we waited for years for the damn disk drive prices to go down, and we were stuck, they didn't make any appreciable change," and now, all of a sudden, it hits a spurt, a new generation comes out in a couple of years, and you've moved an order of magnitude without really having thought about it. (Tool Developer)

This excerpt raises several interesting and important points which apply to other technologies in other settings as well. Recall the discussion about the transformative nature of the printing press in an earlier chapter. In the case of the printing press, books were still being copied out by hand even fifty years after its introduction, and the broader ramifications of the printing press were not apparent until a number of decades had passed (Eisenstein 1979).

One way of thinking about both the magnitude and *durability* of change is to look not for the dramatic instances of transformation, but for the slow and cumulative effect of both the dramatic and the mundane. We can compare this kind of durable transformation to the planet Saturn's rings.[7] These rings are composed of minuscule particles of ice, rock, and dust; individually, these particles are insignificant, but together they produce the beautiful and striking rings we perceive around the planet. Applying this metaphor to the concept of social transformation via computerization, we can begin to recognize how even individual and minor changes can have a dramatic overall impact. This is especially true as what is once in place becomes more and more difficult to dismantle. Kling and Scacchi (1982) refer to this as an organizational *history of commitments*, a series of past decisions about computing which ultimately constrain present choices; similarly, Whittaker and Law (1988) discuss

[7]This metaphor is used in Rowe (1974) to describe the cumulative effect of gender harassment and discrimination.

different degrees of malleability of technical and social systems as technological choices are made manifest by means of physical implementations.

Innovations, particularly the first ones of a kind, often fail outright, or at least fail to live up to their expected potential. This is not startling in any way; early innovation is risky. Early innovators do not benefit from the experiences of others, and may not have the most appropriate materials to draw on. However, individual innovations need not be lasting ones in order to contribute to a larger transformation. We can draw on one particular example in classics: the encoding of texts in electronic form. The TLG, for example, was created in a day of mainframes and limited experience with text encoding— and no experience with projects of such magnitude. Recall that it uses an encoding scheme (referred to as "beta code") developed specifically for the ancient Greek language and specifically for a particular computer system. In order to use the TLG texts on a personal computer and CD ROM reader, users must develop or procure a program to translate beta code into something usable in their editor. In response to the variety of encoding schemes in use and the limited utility of beta code (developed for encoding Greek alone), an international effort, the Text Encoding Initiative (TEI), was mounted. The TEI is designed to provide a device-independent markup scheme for texts used in literary, linguistic, and other textual research.[8]

While it is impossible to state precisely what will occur in the future, in one likely scenario the TEI will become the standard for future text encoding projects. The TLG will be used in parallel for a while, and will ultimately be forced to withdraw and/or convert its texts from beta code to the TEI standard. Yet even if this happens and the TLG disappears from the field, it will still have served as a crucial defining technology and, in some cases, as a foil for other database projects. Both the TLG and other early projects— but the TLG especially— will have served as catalysts for and components of the collectively dramatic impact of computing on classics.

[8]See, for instance, Michael Sperberg-McQueen's note on *Humanist*, v. 3, n. 1259, Wednesday, April 4, 1990. The TEI is an international effort sponsored by the Association for Computers and the Humanities (ACH), the Association of Computational Linguistics (ACL), and the Association for Literary and Linguistic Computing (ALLC). The goal of the TEI is to complete and publish a set of text-encoding standards not limited by language or computer hardware. Its directors/editors come from the United States (Michael Sperberg-McQueen, University of Illinois at Chicago) and the United Kingdom (Lou Burnard, Oxford University). A first draft was made available for comment in mid-1990 (publication of the draft was announce on *Humanist*, v. 4, n. 371, Tuesday, August 7, 1990), with the expectation that a final set of guidelines would be published by 1992. Like computer-based activities in classics, the TEI has not make it into the "mainstream" of the humanities. For instance, there was no TEI workshop as part of the annual meeting of the Modern Language Association, the umbrella organization for language studies. Instead, an independent workshop with about 24 participants was held in Chicago in September 1990, with another North American workshop scheduled for July 1991 in Providence, Rhode Island, and a European one scheduled for July 1991 in Oxford, UK. There were, of course, workshops at the 1991 ACH/ALLC conference in Tempe, Arizona.

8.2.3 The Mute Disks Speak: Anticipating Tomorrow

> ...desire an exact knowledge of the past as an aid to the interpretation of the future.
>
> — Thucydides, *The History of the Peloponnesian War*[9]

One reason classicists give for studying classical literature is that understanding the past helps us to better understand the present. Similarly, we try to understand our past *and* present in order to develop a sensible vision for our future. Based on the picture of the computerization of classics developed in this dissertation, what speculations might we make about the future? The following possibilities vary in their likelihood and in the swiftness with which they might come to pass; some are under way already.

Calls for standardization. In the previous section, I touched on one of the moves towards standardization of text encoding schemes: the TEI. The need for such standards is widely recognized:

> The ...problem [with using a particular program for tagging and searching for linguistic elements and units of discourse] is that there has never been a standard for encoding [texts]. ...Hopefully, [the TEI] will provide us all with a usable standard. (John Baima on *Humanist*, v. 3, n. 1095, Monday, February 26, 1990)

The call for standards for this and other computer-related activities in classics will continue to be heard as the use of computers and the breadth of application develops. At this point, standards such as the TEI are emerging directly from the university user/developer community. In turn, these standards will drive new tool development efforts.[10] As the "humanities computing" user community increases and, in particular, as computing infrastructures develop, both new and established software companies will find lucrative markets as long as they support existing community standards and conventions, or provide viable alternatives.

Re-thinking the products of scholarship. One of the most exciting recent developments is *hypertext*. With the advent of hypertext and and the growing access to multi-media systems, we may expect a radical departure from the traditional manuscript produced by scholars. Instead, "papers" will be developed as hypertext presentations that may include everything from on-line text to graphics, videos, and musical selections. As this form of compilation and presentation of materials becomes more prevalent, our entire style of "reading"

[9]Edmund Burke, on the other hand, wrote, "You can never plan the future by the past" (*Letter to a member of the National Assembly*, 1791). So, what does that tell us?

[10]Of course, some diversity in encoding schemes may remain. Some scholars, for example may encode esoteric texts of interest only to themselves or to a very small and close-knit community of individuals. In this case, the "cost" of learning to use a cumbersome and tedious encoding scheme may not be worth it to them, given the limited "user community."

will be de-linearized and free us from the constraints of the printed page. These ideas are explored in much richer detail elsewhere.[11]

Merging the "two cultures"? In an earlier chapter, I discussed in detail some of the values of classicists, the relationship between classical scholars and their field, and, most importantly perhaps, the special relationship between the scholar and the text. What ramifications will a more computerized discipline have for this "culture of classics"? Some scholars, for instance, argue strongly that the study of literature is subjective, and that the evidence they use and the arguments they put forth are not quantifiable. Others look to the advent of the computer as helping them work more objectively, helping them test hypothesis in the manner of the physical sciences. One faculty member at a university with multiple Ibycuses and personal computers set up in a single room for general use compares the atmosphere to a traditional science lab. As computing becomes more prevalent, will see the development of a lab environment or lab culture in classics?

Similarly, we may speculate on the growth of statistical-based textual and linguistic analyses as both the data and methods for this form of analysis become more accessible to classicists as a group. Will this form of work becomes more acceptable to mainstream classicists? This kind of growth would be comparable to the rise and subsequent prominence of quantitative analysis in the social sciences with the advent of computing. Were such growth to occur, it might lead to debate over the increasing reliance on computing, as is currently taking place in mathematics with respect to computer-generated proofs not duplicable by hand. These changes could lead to the "scientification" of classics?

A classical *Renaissance* at hand? Finally, as the access to and use of information technology becomes more and more prevalent, we will see a resurgence of interest in the humanities. Old questions will be reopened as new evidence can be obtained to reexamine previous conclusions. Questions heretofore beyond the scope of inquiry will be broaches with the use of the new technologies. Graduate students will have resources at their fingertips that previous generations of scholars could only dream about. As humanities computing emerges as a field in its own right, it will draw non-traditional students with an aptitude for and an interest in computing in addition to various fields in the humanities. This change in the composition of the field may help humanists and scientists bridge the gap between the "two cultures." Furthermore, expanding research possibilities and entire new fields of study are leading to a Renaissance in classical studies— indeed, in all fields of the Humanities.

Mediating factors. Are there some elements which will tend to dampen, limit, or focus change within the discipline potential? In classics, one element which grounds the discipline

[11]See, for example, Nelson (1987) or a variety of contributors to Blank and others (1989).

is the paradigmatic stability to which Miall (1990), quoted earlier in this chapter, refers. The advent of computing is not the first time classics as a discipline has been confronted with new means of storing, manipulating, and dissemination information. So far, these changes in media have not yet led to radical shifts in the "classics paradigm," though they have facilitated the process of traditional scholarship.

A different factor to consider is the nature of some of the problems of doing work now being addressed at a predominantly technical level. At the Fall 1990 TEI-sponsored workshop, participants tried to collectively tag a passage from Laurence Sterne's eighteenth century novel, *Tristam Shandy.* In a report on the workshop, on participant wrote,

> It was interesting to note that problems arose not so much from any ambiguity of [the TEI guidelines], but from our inability to decide exactly what it was we were tagging and what features we considered salient. (Elli Mylonas on *Humanist*, v. 4, n. 545, Monday, October 1, 1990)

Similarly, the difficulty in creating a database is not so much in deciding what format to use, as in deciding what information to include, in what form, and by whose decision (recall the procedures for selecting texts for the TLG). While technical possibilities may blossom, the simple fact is that many of the questions that arise in the development of computer-based tools are simply not technical in nature.

These "dampers" on the innovation process are not drawbacks, however. Indeed, the very stability and venerability of the discipline make it a fascinating venue for study. By observing the changes in classics, we can better understand the dimensions and magnitude of similar changes in more volatile domains.

8.3 Future Directions: Whither Now?

> Quickly, bring me a beaker of wine, so that I may wet my mind and say something clever.
>
> —- Aristophanes, *The Knights*

Where to next? In this section, I draw on issues arising from this empirical study to suggest a number of potential areas that could be explored in future research projects. Some of these projects would extend or complement other work that has already been done. I will mention two ideas briefly, then focus on the third one in more detail.

The most direct step, of course, would be to continue directly with the work of this thesis. This could easily lead in a number of directions. I could, for instance, continue to delve more deeply into understanding the social world of classical scholarship, perhaps covering more

extensively another sub-area of classical scholarship, such as linguistic studies. Or I could continue to follow the establishment of a humanities computing social world.

Another option would be to focus on the question of tool development and dissemination. This could involve either a more in-depth study of a tool development project in classics or another branch of the humanities. Perhaps more interestingly, it could involve a series of case studies of other tool development efforts aimed at user communities which share certain features with classicist, such as autonomy and the need to work coherently with very fragmentary data.

I wish to elaborate on a different kind of "future step," one which draws its inspiration from the very loosely-coordinated yet well-ordered forms of collaboration and cooperation among classicists engaged in academic dialogue. Below I examine some of the more general issues, and explore the ways in which this dissertation functions as a pathway towards answering some of the questions raised.

8.3.1 Collaborative Work, Coordinated Work

> Seeing things as the product of people doing things together makes a lot of other views less plausible and less interesting. (Becker 1986)

In order to accomplish larger goals, people work together. In the Humanities, people from a variety of disciplines and backgrounds have worked together to develop the TEI (text-encoding initiative) in order to develop standards for the electronic encoding of literary texts. But how do disparate groups of people manage to work together, especially over time and over space? This is one of the central questions facing those who wish to develop computer-based systems or tools to support cooperative and collaborative work.

Dimensions of Collaboration

> For masterpieces are not single and solitary births; they are the outcome of many years of thinking in common, of thinking by the body of the people, so that the experience of the mass is behind the single voice.
>
> — Virginia Woolf, *A Room of One's Own*

There is a growing interest in the application of computing technologies to collaborative and cooperative work, in which the technology often provides the focal point for joint activity. For instance, a recent report by the National Science Foundation proposes the development of a *national collaboratory*, a focused collaborative system that provides a "mature electronic environment" for research and scholarly inquiry. It is to include multi-media support

for collaboration and coordination of work, commenting and authoring tools, decision support, electronic conferencing capabilities, and infrastructure support for collaborative work (Lederberg and Uncapher 1988, Rosenberg 1990).

In a recent paper on the academic collaboratory, Ruhleder and King (1991) examine the various *dimensions* of collaborative efforts, and their incorporation into the development of systems to support collaborative and cooperative work. Conventional visions of collaborative systems tend to share the following characteristics. They assume a fixed or known set of participants; they focus on technical aspects of the systems rather than on understanding group work; they are often bound to a specific technology and expertise; they provide a limited set of media for information transmission; and they often assume a limited timeframe within which the collaborative activity will take place.

Academic collaboration, however, is based on a very different set of features and circumstances. To *collaborate* is "to work together, esp. in a joint intellectual effort" (American Heritage Dictionary 1985). If we turn to the Academy to seek out examples of this kind of joint intellectual effort, we find that they are often characterized by *varying specificity* in terms of goals and efforts, that cooperation is often *non-uniform*, and that contributions to the effort take place over a long period of time.

As we extend our notion of what "collaborative work" encompasses, let us consider the following excerpt from an interview with a classicist:

> Latinist: I think [scholarship is] a cumulative, collaborative effort, and I think there's room for new interpretations.
>
> Interviewer: You said the work you're doing is a collaborative effort?
>
> Latinist: By collaborative I mean by other scholars over the generations. What I mean was, I talk about interpreting these texts. I didn't mean that I'm approaching them as though one [person] had read them [all].
>
> Interviewer: A collaboration over centuries?
>
> Latinist: The Herculaneum papyri were discovered two centuries ago. I'd say that work, we're still engaged in dialogue with McKenzie in the '60s, so it's not that long a span.

We see here that *contributing to an academic dialogue*, characterized by this informant as a cumulative *and collaborative* effort, can take place literally over years, decades, and centuries. It can involve people who not only never meet each other, but who belong to entirely different generations and nations.

While this is perhaps an extreme example, other domains of work provide similar examples. Systems development efforts and other projects often take a number years to move from

conception to product marketing. During this time, members of the design team come and go, different groups within the organization become involved, authority may shift between individuals or between groups, and even the overall goals of the project may change.

When developing systems to support collaborative work, we must keep in mind that this work takes many forms and that there are many *dimensions* to various collective activity in terms of space, time, and social worlds. We must not only experiment with different forms of *technical* support but, in accordance with Lederberg and Uncapher's call for further research (Lederberg and Uncapher 1988), we must continue to develop a better understanding of group interactions and of the dimensions of collective activity.

Artifacts Supporting Collaborative and Cooperative Work

Artifacts, either physical or conceptual, play an important role in supporting collaborative and cooperative work efforts. We draw on work in the sociology of science and terms these artifacts *boundary objects*. These objects, either concrete or abstract, are plastic enough to adapt to the needs of individual groups, yet robust enough to maintain a common identity across different groups, different sites, and even over time (King and Star 1990, Star *in press*, Star and Bowker 1991, Star and Griesemer 1989). Boundary objects and their manner of access often embody and reinforce a set of *conventions* within one or more social worlds.[12]

[12]To reiterate (from the chapter on classics), boundary objects evolve within a diverse community and become artifacts that are plastic enough to adapt to the needs of individual groups, yet robust enough to maintain a common identity across different groups, different sites, and even over long periods of time. How this process occurs is not yet well understood, but we recognize that such objects, whether concrete or abstract, can serve as bridges between different communities or social subworlds (Star 1987, Star and Griesemer 1989, Star and Bowker 1990). The concept arose from studies of collaborative efforts in scientific work, where contributors to a collaborative effort may come to a project with a highly diverse set of needs and perspectives. Boundary objects and their manner of access often embody and reinforce a set of *conventions* within one or more disciplines, thus freeing its members from the need to constantly renegotiate the methods or materials to be used in their work (Becker 1982, Gilmore 1987).

I distinguish here between four types of boundary objects, paraphrased from Star and Griesemer (1989) and King and Star (1990). Boundary objects can be *repositories*, ordered collections of information indexed in a standardized fashion. Repositories deal with difficulties that arise when people partition problems using different units of analysis, and they have the advantage of modularity. Boundary objects can also serve as ideal *ideal types*, objects which do not accurately describe the details of any one locality or thing but are abstracted from several domains, and may be fairly vague. They arise with differences in degrees of abstraction and result in the deletion of local contingencies from the common object. They can form *coincident boundaries*. These are common objects which have the same boundaries but different internal contents, and they arise in the presence of different means of aggregating data, and when work is distributed over geographic areas. Finally, *standardized forms* can become boundary objects when devised as methods of common communication across dispersed workgroups. They are especially important when work takes place at distributed work sites.

An example drawn from classics is the *Thesaurus Linguae Graecae*, which serves as both a *repository*, providing multiple groups with access to Greek textual sources and as an *ideal type*, representing the *corpus* of Greek literature. It embodies a set of unstated conventions, practices, and disciplinary boundaries, some traditional and some newly created to support this artifact. Although the artifact itself makes use of electronic media, its creation relied on non-electronic means. The notion of an ideal type is further reinforced by the inclusion of only a single version of each text, selected by one or more "experts" in the field.

Again, other kinds of effort serve equally well to provide us with examples of artifacts that help coordinate efforts across members of different organizational units and/or social worlds. Consider again a design project involving a variety of groups within an organization, perhaps with shifting authority. A set of design-related documents, from a broad vision or set of requirements to a detailed analysis, can help focus project discussions. Similarly, these artifacts can help maintain continuity in a setting where people may come and go, or where they work in physically distributed settings.

If we are to create systems to electronically store and maintain these artifacts, we must first understand how they are used in the design process. We must develop a clearer picture of how artifacts can serve as focal points in a discussion that bridges space, time, and worlds of work.

Complementary Modes of Interaction

One particular class of artifacts that can be used to support collaborative and cooperative work are electronic communications media. Certain tasks have traditionally been coupled with certain modes of interaction. For instance, presenting the results of one's research has traditionally taken the form of "reading a paper" or "giving a talk" at a conference or professional meeting; or it has taken the form of a published work, as a journal paper, perhaps, or as a book.

New communications media provide new forms of interaction. For instance, the telephone allows two-way synchronous verbal communication. It does not, however, replace other forms of communication, such as sending a copy of a paper through the mail. These two forms of communication, however, can *complement* each other; one can send a paper through the mail, then call to discuss the other person's comments.

Many studies of the use or impact of electronic mail fail to ask questions about the integration of electronic communication media with *other*, often more traditional means of communication. It is unlikely that electronic mail, for instance, will replace all other modes of interaction. It is essential, however, that we develop an understanding of the role that electronic communications media will play in systems supporting collaborative and cooperative work.

computing becomes integrated into the activities carried out by its members. Classics, a discipline with ancient roots, has grasped the technology of the future to forge a set of tools for its own use. Its members remain true to their discipline's ancient mission while at the same time applying the most modern methods in their inquiries.

What consequences are being wrought with that set of tools and their application to the activities of this social world? We have seen evidence of change to work content and work practices. We have seen evidence of the emergence of new electronic communities and new social worlds for which the computer serves as an important focal point. And we see evidence abounding that these changes will continue to manifest themselves as the toolset grows, as an understanding of its utility develops further, and as computer-based technologies become more deeply and more intricately integrated into the work practices of this scholarly community.

Finally, while answering one small set of questions, a far larger set of questions has been raised. These questions focus especially on issues surrounding collaborative and cooperative work. We must develop a more robust understanding of the dimensions of cooperative and collaborative work efforts, of the kinds of artifacts that can support these efforts, and, finally, of the requirements for successful integration of electronic communications media with tools to support joint work. These questions, however, we must leave for future investigation.

The moving finger writes; and, having writ,
Moves on: nor all your Piety nor Wit
Shall lure it back to cancel half a Line,
Nor all your Tears wash out a Word of it.

— from *The Rubáiyát* of Omar Khayyám

References

Abbott, Evelyn, *A subject-index to the dialogues of Plato; being an index to the matters and names contained in the dialogues of Plato according to the pages of Stephens' edition,* New York: B. Franklin, 1971.

Abramson, Jeffrey B., F. Christopher Arterton, and Gary R. Orren, *The Electronic Commonwealth*, New York, NY: Basic Books, Inc., 1988.

Allen, James Turney, and Gabriel Italie, *A Concordance to Euripides*, Berkeley: University of California Press, 1954.

Allor, Martin, "Information, Institution, and Ideology: On the Discursive Control of Communications Systems," in Jennifer Daryl Slack and Fred Fejes (eds.), *The Ideology of the Information Age*, Ablex, 1987.

American Heritage Dictionary, Boston:Houghton Mifflin Company, 1985.

Angotti, Frank, "Technology, the Role of the Humanities and Moral Responsibility," *INTERFACE '90: Fourteenth Annual Humanities and Technology Conference*, Marietta, Georgia, October 18–19, 1990.

Atkins, J. W. H., *Literary Criticism in Antiquity: A Sketch of its Development*, volume II, New York: Peter Smith, 1952.

Attewell, Paul, and James Rule, "Computing and Organizations: What We Know and What We Don't Know," *Communications of the ACM*, 27(12):1184–1192, 1984.

Bacchylides, *The Poems and Fragments*, edited with introduction, notes and prose translation by Richard C. Jebb, Hildesheim: Georg Olms Verlagsbuchhandlung, 1967.

Bailey, Richard W., "Introduction", in Richard W. Bailey (ed.), *Computing in the Humanities*, Amsterdam: North-Holland, 1981.

Baker, W. O., W. S. Brown, M. V. Mathews, S. P. Morgan, H. O. Pollak, R. C. Prim, and S. Sternberg, "Computers and research," *Science*, 195:1134–1139, 1977.

Bantz, David A., "The Values of the Humanities and the Values of Computing," in David S. Miall (ed.), *Humanities and the Computer: New Directions*, Oxford: Clarendon Press, pp. 39–48, 1990.

Barlow, John Perry, "Crime and Puzzlement: in Advance of the Law on the Electronic Frontier," *Whole Earth Review*, 68:44–57, 1990.

Battin, Patricia, "The Electronic Library— A Vision for the Future," *EDUCOM Bulletin*, Summer:12–17, 1984.

Becker, Howard Saul, *Outsiders: Studies in the Sociology of Deviance*, Glencoe: Free Press, 1963.

Becker, Howard Saul, *Art Worlds*, University of California Press, 1982.

Becker, Howard S., *Doing Things Together: Selected Papers*, Evanston, Illinois: Northwestern University Press, 1986.

Bellin, David, "Living in the Future with Apple's *Knowledge Navigator*, in a report on the 1988 CPSR (Computer Professionals for Social Responsibility) Annual Meeting, *CPSR Newsletter*, 7(1):9–10, 1989.

Bender, Todd K., and Sue M. Briggum, "Quantitative Stylistic Analysis of Impressionist Style in Joseph Conrad and Ford Madox Ford," in Richard W. Bailey, editor, *Computing in the Humanities*, Amsterdam: North Holland, 1981.

Beninger, James, *The Control Revolution: Technological and Economic Origins of the Information Society*, Cambridge, MA: Harvard University Press, 1986.

Benjamin, Walter, "The Work of Art in the Age of Mechanical Reproduction," in Benjamin Walter (Hannah Arendt, editor; Harry Zohn, translator), *Illuminations*, pp. 217–251, 1968.

Berkowitz, Luci and Karl A. Squitier, *Thesaurus Linguae Graecae Canon of Greek Authors and Works*, New York: Oxford University Press, 1986.

Bernal, Martin, *Black Athena: The Afroasiatic Role of Classical Civilization*, New Brunswick, NJ: Rutgers University Press, 1987.

Bessant, John and Alec Chisholm, "Human Factors in Computer-Integrated Manufacturing," in Tom Forester (ed.), *Computers in the Human Context*, Cambridge, Mass.: MIT Press, 1989.

Bikson, Tora K., J. D. Eveland and Barbara Gutek, "Flexible Interactive Technologies for Multi-Person Tasks: Current Problems and Future Prospects," in Margrethe H. Olson (ed.) *Technological Support for Work Group Collaboration*, Lawrence Erlbaum Associates, pp. 89–112, 1989.

Blank, Grant, James L. McCartney, and Edward Brent, eds. *New Technology in Sociology: Practical Applications in Research and Work*, New Brunswick: Transaction Publishers, 1989.

Blau, Peter Michael, *The Organization of Academic Work*, New York: John Wiley & Sons, 1973.

Blumer, Herbert, *Symbolic Interactionism: Perspective and Method*, UC Press, 1969.

Bly, Sara A, "A use of drawing surfaces in different collaborative settings," *Proceedings of the Conference on Computer-Supported Cooperative Work*, September 26–28, Portland, OR. pp. 250–256, 1988.

Bly, Sara A. and Scott L. Minneman, "Commune: A shared drawing surface." *Proceedings, Conference on Office Information Systems*, April 25–27, Cambridge, MA, pp. 184–192, 1990.

Boddy, D. and D. Buchanan, "Information Technology and Productivity: Myths and Realities," *Omega (International Journal of Management Science)*, 12(3):233–240, 1984.

Bodleian Library, *Printing and Publishing at Oxford: The Growth of a Learned Press, 1478–1978*, Oxford: The Library, 1978.

Bolgar, R. R., "The Greek Legacy," in M. I. Finley, *The Legacy of Greece: A New Appraisal*, Oxford: Clarendon Press, 1981.

Bolter, J. David, *Turing's Man: Western Culture in the Computer Age*, Chapel Hill: University of North Carolina Press, 1984.

Boulton, Marjorie, *The Anatomy of Literary Studies: An Introduction to the study of English Literature*, London: Routledge & Kegan Paul, 1980.

Bowen, William, "The Puny Payoff from Office Computers," *Fortune*, May 26, 1986.

Brandwood, Leonard, *A Word Index to Plato*, Leeds: W.S. Maney and Son, 1976.

Braverman, Harry, "Labor and Monopoly Capital: The Degredation of Work in the Twentieth Century," em Monthly Review Press, New York, 1974.

Brennan, Elaine and Allen Renear, editors, "Death and Loss of Name," *Humanist Mailing List*, Monday, 4(756), November 26, 1990.

Brooks, Harvey, "Technology, Evolution, and Purpose," *Daedelus*, Winter:65–81, 1980.

Brunner, Theodore F., "Data Banks for the Humanities: Learning from the *Thesaurus Linguae Graecae*," *Scholarly Communication*, Winter, 1987.

Brunner, Theodore F., "Overcoming 'Verzettelung,' " *Humanities*, 9(3), 1988.

Brunner, Theodore F., "Databanks in the Humanities: Past, Present, and Future," keynote address, *Combined 16th International Association for Literary and Linguistic Computing Conference and 9th International Conference on Computers and the Humanities*, University of Toronto, June 5–10, 1989.

Buchanan, David A., "Using the New Technology," in Tom Forester (ed.), *The Information Technology Revolution*, Cambridge, MA: MIT Press, 1985.

Bucher, Rue, and Anselm Strauss, "Professions in Process," *American Journal of Sociology*, 66(4):325–334, 1961.

Burnard, Lou, "HUMANIST So Far: A Report on Activities, August 1987 to January 1988," Oxford University Computing Service, available via *Humanist*, 1988 (a).

Burnard, Lou, "HUMANIST So Far: Third Summary on Activities, February to July 1988," Oxford University Computing Service, available via *Humanist*, 1988 (b).

Burnham, David, *The Rise of the Computer State*, New York: Random House, 1983.

Burton, Sarah K. and Douglas D. Short, eds., *Proceedings of the Sixth International Conference on Computers and the Humanities*, Rockville, MD: Computer Science Press, 1983.

Becker, Howard S., *Doing Things Together: Selected Papers*, Evanston, Illinois: Northwestern University Press, 1986.

Bellin, David, "Living in the Future with Apple's *Knowledge Navigator*, in a report on the 1988 CPSR (Computer Professionals for Social Responsibility) Annual Meeting, *CPSR Newsletter*, 7(1):9–10, 1989.

Bender, Todd K., and Sue M. Briggum, "Quantitative Stylistic Analysis of Impressionist Style in Joseph Conrad and Ford Madox Ford," in Richard W. Bailey, editor, *Computing in the Humanities*, Amsterdam: North Holland, 1981.

Beninger, James, *The Control Revolution: Technological and Economic Origins of the Information Society*, Cambridge, MA: Harvard University Press, 1986.

Benjamin, Walter, "The Work of Art in the Age of Mechanical Reproduction," in Benjamin Walter (Hannah Arendt, editor; Harry Zohn, translator), *Illuminations*, pp. 217–251, 1968.

Berkowitz, Luci and Karl A. Squitier, *Thesaurus Linguae Graecae Canon of Greek Authors and Works*, New York: Oxford University Press, 1986.

Bernal, Martin, *Black Athena: The Afroasiatic Role of Classical Civilization*, New Brunswick, NJ: Rutgers University Press, 1987.

Bessant, John and Alec Chisholm, "Human Factors in Computer-Integrated Manufacturing," in Tom Forester (ed.), *Computers in the Human Context*, Cambridge, Mass.: MIT Press, 1989.

Bikson, Tora K., J. D. Eveland and Barbara Gutek, "Flexible Interactive Technologies for Multi-Person Tasks: Current Problems and Future Prospects," in Margrethe H. Olson (ed.) *Technological Support for Work Group Collaboration*, Lawrence Erlbaum Associates, pp. 89–112, 1989.

Blank, Grant, James L. McCartney, and Edward Brent, eds. *New Technology in Sociology: Practical Applications in Research and Work*, New Brunswick: Transaction Publishers, 1989.

Blau, Peter Michael, *The Organization of Academic Work*, New York: John Wiley & Sons, 1973.

Blumer, Herbert, *Symbolic Interactionism: Perspective and Method*, UC Press, 1969.

Bly, Sara A, "A use of drawing surfaces in different collaborative settings," *Proceedings of the Conference on Computer-Supported Cooperative Work*, September 26–28, Portland, OR. pp. 250–256, 1988.

Bly, Sara A. and Scott L. Minneman, "Commune: A shared drawing surface." *Proceedings, Conference on Office Information Systems*, April 25–27, Cambridge, MA, pp. 184–192, 1990.

Boddy, D. and D. Buchanan, "Information Technology and Productivity: Myths and Realities," *Omega (International Journal of Management Science)*, 12(3):233–240, 1984.

Bodleian Library, *Printing and Publishing at Oxford: The Growth of a Learned Press, 1478–1978*, Oxford: The Library, 1978.

Bolgar, R. R., "The Greek Legacy," in M. I. Finley, *The Legacy of Greece: A New Appraisal*, Oxford: Clarendon Press, 1981.

Bolter, J. David, *Turing's Man: Western Culture in the Computer Age*, Chapel Hill: University of North Carolina Press, 1984.

Boulton, Marjorie, *The Anatomy of Literary Studies: An Introduction to the study of English Literature*, London: Routledge & Kegan Paul, 1980.

Bowen, William, "The Puny Payoff from Office Computers," *Fortune*, May 26, 1986.

Brandwood, Leonard, *A Word Index to Plato*, Leeds: W.S. Maney and Son, 1976.

Braverman, Harry, "Labor and Monopoly Capital: The Degredation of Work in the Twentieth Century," em Monthly Review Press, New York, 1974.

Brennan, Elaine and Allen Renear, editors, "Death and Loss of Name," *Humanist Mailing List*, Monday, 4(756), November 26, 1990.

Brooks, Harvey, "Technology, Evolution, and Purpose," *Daedelus*, Winter:65–81, 1980.

Brunner, Theodore F., "Data Banks for the Humanities: Learning from the *Thesaurus Linguae Graecae*," *Scholarly Communication*, Winter, 1987.

Brunner, Theodore F., "Overcoming 'Verzettelung,' " *Humanities*, 9(3), 1988.

Brunner, Theodore F., "Databanks in the Humanities: Past, Present, and Future," keynote address, *Combined 16th International Association for Literary and Linguistic Computing Conference and 9th International Conference on Computers and the Humanities*, University of Toronto, June 5–10, 1989.

Buchanan, David A., "Using the New Technology," in Tom Forester (ed.), *The Information Technology Revolution*, Cambridge, MA: MIT Press, 1985.

Bucher, Rue, and Anselm Strauss, "Professions in Process," *American Journal of Sociology*, 66(4):325–334, 1961.

Burnard, Lou, "HUMANIST So Far: A Report on Activities, August 1987 to January 1988," Oxford University Computing Service, available via *Humanist*, 1988 (a).

Burnard, Lou, "HUMANIST So Far: Third Summary on Activities, February to July 1988," Oxford University Computing Service, available via *Humanist*, 1988 (b).

Burnham, David, *The Rise of the Computer State*, New York: Random House, 1983.

Burton, Sarah K. and Douglas D. Short, eds., *Proceedings of the Sixth International Conference on Computers and the Humanities*, Rockville, MD: Computer Science Press, 1983.

Busa, Roberto, editor, *S. Thomae Aquinatis Opera Omnia: ut sunt in Indice Thomistico, additis 61 scriptis ex aliis medii aevi auctoribus*, [Complete works of Saint Thomas Aquinas...], Stuttgart–Bad Cannstatt: Frommann-Holzboog, 1980.

Campbell, Donald T., "Ethnocentrism of Disciplines and the Fish-Scale Model of Omniscience," In Muzafer Sherif and Carolyn W. Sherif, editors, *Interdisciplinary Relationships in the Social Sciences*, Chicago: Aldine Publishing Company, 1969.

Caro, Robert A., *The Power Broker: Robert Moses and the Fall of New York*, New York: Knopf, 1974.

Cavenaile, Robert, *Corpus papyrorum Latinarum*, Wiesbaden: O. Harrossowitz, 1958.

Child, J. and R. Mansfield, "Technology, size and organization structure," *Sociology* 6:369–393, 1972.

Clanchy, M. T., *From Memory to Written Record*, London: Edward Arnold, 1979.

Cleveland, H., "The Twilight of Hierarchy: Speculations on the Global Information Society," in B. Guilde (ed.), *Information Technologies and Social Transformation*, Washington, DC: National Academy Press, 1985.

Collard, Christopher, *Supplement to the Allen & Italie Concordance to Euripides*, Groningen: Bouma's Boekhuis, 1971.

Collins, Harry M., "Expert Systems and the Science of Knowledge," in Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch (eds.), *The Social Construction of Technological Systems*, MIT Press, 1987.

Collins, H. M., R. H. Green, and R. C. Draper, "Where's the Expertise: Expert Systems as a Medium of Knowledge Transfer," in Martin Merry (ed.), *Expert Systems 85*, Cambridge University Press, 1985.

Crane, Diana, *Invisible Colleges: Diffusion of Knowledge in Scientific Communities*, Chicago: University of Chicago Press, 1972.

Crane, Gregory, Editor in Chief, *Perseus Project: Interactive Sources and Studies on Ancient Greece*, project information sheet, Perseus Project, Department of the Classics, 319 Boylston Hall, Harvard University, Cambridge, MA 02138, August 15, 1989.

Daniels, Arlene Kaplan, "Invisible Work," *Social Problems* 34(5):403–415, 1987.

Danziger, James N., "Waiting for the Revolution: The Use of Microcomputers by Social Scientists," in Grant Blank, James L. McCartney, and Edward Brent (eds.) *New Technology in Sociology: Practical Applications in Research and Work*, New Brunswick: Transaction Publishers, pp. 57–78, 1989.

Davidson, Fred C., "Computing at the University of Georgia: Critical Success Factors," *EDUCOM Bulletin*, 19(1):5–10, 1984.

Dean, James W., *Deciding to Innovate: How Firms Justify Advanced Technology*, Cambridge, MA: Ballinger Publishing, 1987.

Downs, George W., *Bureaucracy, Innovation and Public Policy*, Lexington Books, 1976.

Dunbar, Henry, *A Complete Concordance to the Comedies and Fragments of Aristophanes*, Oxford: Clarendon Press, 1883.

Dutton, William H, and Kenneth L. Kraemer, *Modeling as Negotiating: The Political Dynamics of Computer Models in the Policy Process*, Norwood, N.J.: Ablex Publishing Corporation, 1985.

Eagleton, Terry, *Literary Theory: An Introduction*, 1983.

Edidin, Peter, "Inside *Publishing*," bi-monthly column, *Lingua Franca*, December, p. 10 ff., 1990.

Eisenstein, Elizabeth L., "The Printing Press as an Agent of Change," Cambridge University Press, 1979.

Eisenstein, Elizabeth L., *The Printing Revolution in Early Modern Europe*, Cambridge: Cambridge University Press, 1983.

Eiteljorg, Harrison, "Handling Imprecision With Computer Data Bases," *Newsletter of the Center for the Study of Architecture*, 2(2), 1989.

Ellul, Jacques, *The Technological Society*, translated from the French by John Wilkinson, New York: Knopf, 1964.

Emery, James C., "Issues in Building an Information Technology Strategy," *EDUCOM Bulletin*, Fall:4–13, 1984.

Ennals, Richard, *Humanities and Computing*, in Sebastian Rahtz (ed.), *Information Technology in the Humanities: Tools, Techniques, and Applications*, Chichester, England: Ellis Horwood Limited, 1987.

Eveland, J. D. and Tora K. Bikson, "Evolving Electronic Communication Networks: An Empirical Assessment," *Office: Technology and People*, 3:103–128, 1987.

Farghaly, Ali, "A Model for Intelligent Computer Assisted Language Instruction (MICAL)," *Computers and the Humanities*, 23(3):235–250, 1989.

Feldman, Martha, "Electronic Mail and Weak Ties in Organizations," *Office: Technology and People*, 3:83–101, 1987.

Feller, Irwin, Donald C. Menzel, and Alfred J. Engel, *Diffusion of Technology in State Mission-Oriented Agencies*, Center for the Study of Science Policy, Institute for Research on Human Resources, The Pennsylvania State University, 1974.

Fidler, Lori A., and J. David Johnson, "Communication and Innovation Implementation," *Academy of Management Review*, 9(4):704–711, 1984.

Finholt, Tom, and Lee Sproull, "Electronic Groups at Work," *Organization Science*, September 1988.

Finley, M. I., ed., *The Legacy of Greece: A New Appraisal*, Oxford: Clarendon Press, 1981.

Boddy, D. and D. Buchanan, "Information Technology and Productivity: Myths and Realities," *Omega (International Journal of Management Science)*, 12(3):233–240, 1984.

Bodleian Library, *Printing and Publishing at Oxford: The Growth of a Learned Press, 1478–1978*, Oxford: The Library, 1978.

Bolgar, R. R., "The Greek Legacy," in M. I. Finley, *The Legacy of Greece: A New Appraisal*, Oxford: Clarendon Press, 1981.

Bolter, J. David, *Turing's Man: Western Culture in the Computer Age*, Chapel Hill: University of North Carolina Press, 1984.

Boulton, Marjorie, *The Anatomy of Literary Studies: An Introduction to the study of English Literature*, London: Routledge & Kegan Paul, 1980.

Bowen, William, "The Puny Payoff from Office Computers," *Fortune*, May 26, 1986.

Brandwood, Leonard, *A Word Index to Plato*, Leeds: W.S. Maney and Son, 1976.

Braverman, Harry, "Labor and Monopoly Capital: The Degredation of Work in the Twentieth Century," em Monthly Review Press, New York, 1974.

Brennan, Elaine and Allen Renear, editors, "Death and Loss of Name," *Humanist Mailing List*, Monday, 4(756), November 26, 1990.

Brooks, Harvey, "Technology, Evolution, and Purpose," *Daedelus*, Winter:65–81, 1980.

Brunner, Theodore F., "Data Banks for the Humanities: Learning from the *Thesaurus Linguae Graecae*," *Scholarly Communication*, Winter, 1987.

Brunner, Theodore F., "Overcoming 'Verzettelung,' " *Humanities*, 9(3), 1988.

Brunner, Theodore F., "Databanks in the Humanities: Past, Present, and Future," keynote address, *Combined 16th International Association for Literary and Linguistic Computing Conference and 9th International Conference on Computers and the Humanities*, University of Toronto, June 5–10, 1989.

Buchanan, David A., "Using the New Technology," in Tom Forester (ed.), *The Information Technology Revolution*, Cambridge, MA: MIT Press, 1985.

Bucher, Rue, and Anselm Strauss, "Professions in Process," *American Journal of Sociology*, 66(4):325–334, 1961.

Burnard, Lou, "HUMANIST So Far: A Report on Activities, August 1987 to January 1988," Oxford University Computing Service, available via *Humanist*, 1988 (a).

Burnard, Lou, "HUMANIST So Far: Third Summary on Activities, February to July 1988," Oxford University Computing Service, available via *Humanist*, 1988 (b).

Burnham, David, *The Rise of the Computer State*, New York: Random House, 1983.

Burton, Sarah K. and Douglas D. Short, eds., *Proceedings of the Sixth International Conference on Computers and the Humanities*, Rockville, MD: Computer Science Press, 1983.

Busa, Roberto, editor, *S. Thomae Aquinatis Opera Omnia: ut sunt in Indice Thomistico, additis 61 scriptis ex aliis medii aevi auctoribus*, [Complete works of Saint Thomas Aquinas...], Stuttgart–Bad Cannstatt: Frommann-Holzboog, 1980.

Campbell, Donald T., "Ethnocentrism of Disciplines and the Fish-Scale Model of Omniscience," In Muzafer Sherif and Carolyn W. Sherif, editors, *Interdisciplinary Relationships in the Social Sciences*, Chicago: Aldine Publishing Company, 1969.

Caro, Robert A., *The Power Broker: Robert Moses and the Fall of New York*, New York: Knopf, 1974.

Cavenaile, Robert, *Corpus papyrorum Latinarum*, Wiesbaden: O. Harrossowitz, 1958.

Child, J. and R. Mansfield, "Technology, size and organization structure," *Sociology* 6:369–393, 1972.

Clanchy, M. T., *From Memory to Written Record*, London: Edward Arnold, 1979.

Cleveland, H., "The Twilight of Hierarchy: Speculations on the Global Information Society," in B. Guilde (ed.), *Information Technologies and Social Transformation*, Washington, DC: National Academy Press, 1985.

Collard, Christopher, *Supplement to the Allen & Italie Concordance to Euripides*, Groningen: Bouma's Boekhuis, 1971.

Collins, Harry M., "Expert Systems and the Science of Knowledge," in Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch (eds.), *The Social Construction of Technological Systems*, MIT Press, 1987.

Collins, H. M., R. H. Green, and R. C. Draper, "Where's the Expertise: Expert Systems as a Medium of Knowledge Transfer," in Martin Merry (ed.), *Expert Systems 85*, Cambridge University Press, 1985.

Crane, Diana, *Invisible Colleges: Diffusion of Knowledge in Scientific Communities*, Chicago: University of Chicago Press, 1972.

Crane, Gregory, Editor in Chief, *Perseus Project: Interactive Sources and Studies on Ancient Greece*, project information sheet, Perseus Project, Department of the Classics, 319 Boylston Hall, Harvard University, Cambridge, MA 02138, August 15, 1989.

Daniels, Arlene Kaplan, "Invisible Work," *Social Problems* 34(5):403–415, 1987.

Danziger, James N., "Waiting for the Revolution: The Use of Microcomputers by Social Scientists," in Grant Blank, James L. McCartney, and Edward Brent (eds.) *New Technology in Sociology: Practical Applications in Research and Work*, New Brunswick: Transaction Publishers, pp. 57–78, 1989.

Davidson, Fred C., "Computing at the University of Georgia: Critical Success Factors," *EDUCOM Bulletin*, 19(1):5–10, 1984.

Dean, James W., *Deciding to Innovate: How Firms Justify Advanced Technology*, Cambridge, MA: Ballinger Publishing, 1987.

Downs, George W., *Bureaucracy, Innovation and Public Policy*, Lexington Books, 1976.

Dunbar, Henry, *A Complete Concordance to the Comedies and Fragments of Aristophanes*, Oxford: Clarendon Press, 1883.

Dutton, William H, and Kenneth L. Kraemer, *Modeling as Negotiating: The Political Dynamics of Computer Models in the Policy Process*, Norwood, N.J.: Ablex Publishing Corporation, 1985.

Eagleton, Terry, *Literary Theory: An Introduction*, 1983.

Edidin, Peter, "Inside *Publishing*," bi-monthly column, *Lingua Franca*, December, p. 10 ff., 1990.

Eisenstein, Elizabeth L., "The Printing Press as an Agent of Change," Cambridge University Press, 1979.

Eisenstein, Elizabeth L., *The Printing Revolution in Early Modern Europe*, Cambridge: Cambridge University Press, 1983.

Eiteljorg, Harrison, "Handling Imprecision With Computer Data Bases," *Newsletter of the Center for the Study of Architecture*, 2(2), 1989.

Ellul, Jacques, *The Technological Society*, translated from the French by John Wilkinson, New York: Knopf, 1964.

Emery, James C., "Issues in Building an Information Technology Strategy," *EDUCOM Bulletin*, Fall:4–13, 1984.

Ennals, Richard, *Humanities and Computing*, in Sebastian Rahtz (ed.), *Information Technology in the Humanities: Tools, Techniques, and Applications*, Chichester, England: Ellis Horwood Limited, 1987.

Eveland, J. D. and Tora K. Bikson, "Evolving Electronic Communication Networks: An Empirical Assessment," *Office: Technology and People*, 3:103–128, 1987.

Farghaly, Ali, "A Model for Intelligent Computer Assisted Language Instruction (MICAL)," *Computers and the Humanities*, 23(3):235–250, 1989.

Feldman, Martha, "Electronic Mail and Weak Ties in Organizations," *Office: Technology and People*, 3:83–101, 1987.

Feller, Irwin, Donald C. Menzel, and Alfred J. Engel, *Diffusion of Technology in State Mission-Oriented Agencies*, Center for the Study of Science Policy, Institute for Research on Human Resources, The Pennsylvania State University, 1974.

Fidler, Lori A., and J. David Johnson, "Communication and Innovation Implementation," *Academy of Management Review*, 9(4):704–711, 1984.

Finholt, Tom, and Lee Sproull, "Electronic Groups at Work," *Organization Science*, September 1988.

Finley, M. I., ed., *The Legacy of Greece: A New Appraisal*, Oxford: Clarendon Press, 1981.

Forester, Tom, "Making Sense of IT," in Tom Forester (ed.), *Computers in the Human Context*, Cambridge, Mass.: MIT Press, 1989.

Franke, Richard H., "Technological Revolution and Productivity Decline: The Case of US Banks," *Technological Forecasting and Social Change*, 31:143–54, 1987.

Frantzich, Stephen E., *Computers in Congress: The Politics of Information*, Sage Publications, 1982.

Freeman, L., "Q-analysis and the Streucture of Friendship Networks," *International Journal of Man-Machine Studies*, 12(3):367–378, 1980.

Fujimura, Joan Hideko, "The Molecular Biological Bandwagon in Cancer Research: Where Social Worlds Meet," *Social Problems*, 35(3):261–283, 1988.

Fujimura, Joan Hideko, *Bandwagons in Science: Doable Problems and Transportable Packages in the Development of the Molecular Genetic Bandwagon in Cancer Research*, Ph.D. dissertation, University of California, Berkeley, 1986.

Fuller, R. Buckminster, "Utopia or Oblivion," in Albert H. Teich, editor, *Technology and Man's Future*, 1981.

Garson, Barbara, *The Electronic Sweatshop: How Computers are Transforming the Office of the Future into the Factory of the Past*, New York: Simon and Schuster, 1988.

Gellner, Ernest, "The Stakes in Anthropology," *The American Scholar*, Winter:17–30, 1988.

George, Joey F. and John Leslie King, "The Computerization and Centralization Debate," *Communications of the ACM*, forthcoming 1991.

Gershuny, Jonathan, and Ian Miles, *The New Service Economy: The Transformation of Employment in Industrial Societies*, London: Frances Pinter, 1983.

Gerson, Elihu M., "Scientific Work and Social Worlds," *Knowledge: Creation, Diffusion, Utilization*, 4(3):357–377, 1983.

Gilmore, Samuel L., "Coordination and convention: The organization of the concert world," *Symbolic Interaction*, 10(2):209–227, 1987.

Gilmore, Samuel L., "Schools of activity and innovation," *The Sociological Quarterly*, 29(2):203–219, 1988.

Giuliano, Vincent E., "The Mechanization of Office Work," in Tom Forester (ed.), *The Information Technology Revolution*, Cambridge, Mass.: MIT Press, 1985.

Glaser, Barney G. and Anselm L. Strauss, *The Discovery of Grounded Theory*, New York: Aldine Publishing Company, 1967.

Glaser, Nona Y., "Servants to Capital: Unpaid Domestic Lator and Paid Work," in Naomi Gerstel and Harriet Gross (eds.), *Families and Work*, Philodelphia: Temple University Press, 1987.

Glassman, R. B., "Persistence and Loose Coupling in Living Systems," *Behavioral Science*, 18:83–98, 1973.

Goffman, Erving, *Asylums*, Harmondsworth: Penguin Books, 1961.

Goffman, Erving, *The Presentation of Self in Everyday Life*, Anchor Books, 1959.

Graff, Gerald, *Professing Literature: An Institutional History*, The University of Chicago Press, 1987.

Gray, Virginia, "Innovation in the States: A Diffusion Study," *American Political Science Review*, 67:1173–1185, 1973.

Greenberg, Saul, "Sharing views and interactions with single-user applications," *Proceedings, Conference on Office Information Systems*, April 25–27, Cambridge, MA, pp. 227–237, 1990.

Gurbaxani, Vijay, and Seungjin Whang, "The Impact of Information Systems on Organizations and Markets," *Communications of the ACM*, forthcoming.

Harriott, Rosemary, *Poetry and Criticism Before Plato*, London: Methuen & Co. Ltd., 1969.

Harris, Catherine L., with others, "Office Automation: Making it Pay Off," in Tom Forester (ed.), *Computers in the Human Context*, Cambridge, Mass.: MIT Press, 1989.

Harvard Studies in Classical Philology, Cambridge, MA: Harvard University Press, 1890–.

Harvey, Sir Paul, *The Oxford Companion to Classical Literature*, Oxford: Oxford University Press, 1986

Havelock, Eric A., *The Muse Learns to Write: Reflections on Orality and Literacy from Antiquity to the Present*, New Haven: Yale University Press, 1986.

Heim, Michael, *Electric Language: A Philosophical Study of Word Processing*, New Haven: Yale University Press, 1987.

Heisenberg, Werner, *Physics and Phillosophy; The Revolution in Modern Science*, New York: Harper, 1958.

Hiltz, Starr Roxanne, *Online Communities: A Case Study of the Office of the Future*, Norwood, NJ: Ablex, 1984.

Hirschheim, Rudy, Steve Smithson, and Diane Whitehouse, *Microcomputers and the Humanities*, New York: Ellis Horwood, 1990.

Hirschhorn, Larry, *Beyond Mechanization: Work and Technology in a Postindustrial Age*, Cambridge, MA: MIT Press, 1984.

Hockey, Susan M., *A Guide to Computer Applications in the Humanities*, Baltimore: Johns Hopkins University Press, 1980.

Hodges, John C. and Mary E. Whitten, editors, *Harbrace College Handbook*, eigth edition, New York: Harcourt Brace Janovich, Inc., 1977.

Hoerr, John, Michael A. Pollock, and David E. Whiteside, "Management Discovers the Human Side of Automation," in Tom Forester (ed.), *Computers in the Human Context*, Cambridge, Mass.: MIT Press, 1989.

Holmes, Glyn, "Editorial," *Computers and the Humanities*, 23(1), 1989.

Homer, *Homeri Ilias*, edidit Thomas W. Allen, New York: Arno Press, c. 1931, reprinted 1979.

Homer, *Homeri Odyssea*, recognovit P. von der Muehll, Stutgardiae: Teubneri, 1984.

Housman, A. E., *Selected Prose*, ed. J. Carter, Cambridge, 1961.

Howard, Robert, *Brave New Workplace*, Penguin Books, 1985.

Hughes, Everett, "Going Concerns: The Study of American Institutions," in *The Sociological Eye: Selected Papers on Institutions and Race*, pp. 249–327, Chicago: Aldine, 1971.

Hughes, John J., "Studying ancient Greek civilization interactively— The Perseus Project." *Bits and Bytes Review*, 1(1):1–12, 1986.

Hughes, John J., "From Homer to Hesychius— The Thesaurus Linguae Graecae project." *Bits and Bytes Review*, 1(7):1–6, 1987.

Hughes, Thomas P., *Networks of Power: Electrification in Western Society*, Baltimore: The Johns Hopkins University Press, 1983.

Humanist Mailing List, for information contact editors Elaine Brennan and Allen Renear, electronicaly at *editors@brownvm.brown.edu.*

Hurwood, Bernhardt J., *Writing Becomes Electronic*, New York: Congdon & Weed, Inc., 1986

Huxley, Aldous, *Brave New World: A Novel*, London: Chatto & Windus, 1932.

Iacono, Suzanne and Rob Kling, *Changing Office Technologies and Transformations of Clerical Work: A Historical Perspective*, Irvine, CA: Public Policy Research Organization, 1984.

ICIT Research Study Team #2, *Measuring Business Value of Information Technologies*, Washington, D.C.: International Center for Information Technologies, 1988.

Inose, Hiroshi, and John R. Pierce, *Information Technology and Civilization*, New York: W. H. Freeman, 1984.

Inscriptiones Graecae, consilio et autoritate Academiae Literarum Regiae Borussicae editae. Berolini: apud Gualterum de Gruyter et Socios, 1924–.

Inscriptions de Delos, Paris: H. Champion, 1926–.

Ivins, William M., *Prints and Visual Communication*, Harvard University Press, 1953.

Johnson, Bonnie McDaniel, and Ronald E. Rice, *Managing Organizational Innovation: The Evolution from Word Processing to Office Information Systems*, New York: Columbia University Press, 1987

Jones, John Melville, *A Dictionary of Greek Coins*, London: Seaby, 1986.

Keen, Peter G. W., *Competing in Time: Using Telecommunications for Competitive Advantage*, updated and expanded, Cambridge, MA: Ballinger Publishing Company, 1988.

Keen, Peter G. W., *Shaping the Future: Business Design Through Information Technology*, Harvard Business School Press, 1991.

Kerr, Clark, *The Uses of the University*, Cambridge: Harvard University press, 1964.

King, John Leslie and Susan Leigh Star, "Conceptual Foundations for the Support of Organizational Decision Support Systems," in Nunamaker, J. (ed), Volume 3, *Proceedings of the 23rd Annual Hawaii International Conference on Systems Science*, Washington, DC: IEEE Press, pp. 143-151, 1990.

Kling, Rob, "Social Analysis of Computing," *ACM Computing Surveys*, 12(1):61–110, 1978.

Kling, Rob, "Reading 'All About' Computerization: Five Common Genres of Social Analysis," *Proceedings of the 1990 Conference on Directions and Implications of Advanced Computing*, Norwood, NJ: Ablex Publishing Co., 1990.

Kling, Rob, and Elihu M. Gerson, "Patterns of Segmentation and Intersectin in the Computing World," *Symbolic Interaction*, 1(2):24-43, Spring 1978.

Kling, Rob, and Suzanne Iacono, "The Mobilization of Support for Computerization: the Role of Computerization Movements," *Social Problems*, 35(3):226–248, 1988.

Kling, Rob, and Walt Scacchi, "Recurrent Dilemmas of Computer Use in Complex Organizations," *Proceedings of the National Computing Conference*, New York, 1979.

Kling, Rob, and Walt Scacchi, "The Web of Computing: Computer Technology as Social Organization", *Advances in Computers*, v. 21, 1982.

Kling, Rob and Clark Savage Turner, "The Information Labor Force," in Rob Kling, Spencer Olin, and Mark Poster, editors, *Postsuburban California: The Transformation of Orange County since World War II*, Berkeley: University of California Press, 1991.

Koch, Susan E., "How Electronic Networks are Changing Science: Implications for a National Research and Education Network," *Final Report Submitted to the Office of Technology Assessment, U.S. Congress*, December 15,. 1989.

Kraemer, Kenneth L., Siegfried Dickhoven, Susan Fallows Tierney, and John Leslie King, *Datawars: The Politics of Modeling in Federal Policymaking*, New York: Columbia University Press, 1987.

Kraemer, Kenneth L., William H. Dutton, "The Interests Served by Technological Reform: The Case of Computing," *Administration and Society*, 11(1):80–106, 1979.

Kraemer, Kenneth L. and John Leslie King, "Social Analysis in MIS: The Irvine School, 1970–1990," in Nunamaker, J. (ed), Volume 3, *Proceedings of the 23rd Annual Hawaii International Conference on Systems Science*, Washington, DC: IEEE Press, pp. 143-151, 1990.

Kraemer, Kenneth L, James L. Perry, John Leslie King, and Deborah Dunkle, *Institutionalization of Technological Change in Public Organizations*, technical report, Public Policy Research Organization, University of California, Irvine, 1988.

Kranzberg, Melvin, "The Information Age," in Tom Forester (ed.), *Computers in the Human Context*, Cambridge, Mass.: MIT Press, 1989.

Kren, George M., and George Christakes, *Scholars and Personal Computers: Microcomputing in the Humanities and Social Sciences*, New York, NY: Human Sciences Press, 1988.

Kresik, Stephen, editor, *Contemporary Literary Hermeneutics and Interpretation of Classical Texts*, University of Ottawa Press, 1981.

Kuhn, Thomas S., *The Structure of Scientific Revolutions*, University of Chicago Press, 1970.

L'Annee Philologique, Paris: Societe d'edition "Les Belles Lettres," 1924/1926, 1928–.

Lasswell, Harold D., "Policy Problems of a Data-Rich Civilization," in Alan F. Westin (ed.), *Information Technology in a Democracy*, Cambridge, MA: Harvard University Press, 1971.

Latour, Bruno, "Visualization and Cognition: Thinking With Eyes and Hands," *Knowledge and Society: Studies in the Sociology of Culture Past Present*, 6:1–40, 1986.

Latour, Bruno, *Science in Action: How to Follow Scientists and Engineers Through Society*, Cambridge, MA: Harvard University Press, 1987.

Latour, Bruno, and Steve Woolgar, *Laboratory Life: The Social Construction of Scientific Facts*, Beverly Hills: Sage Publications, 1979.

Law, John, and John Whittaker, "Why the PC is not a Projectile," unpublished draft, 1988.

Lawrence, John Shelton, and Bernard Timberg (eds.), *Fair Use and Free Inquiry: Copyright Law and the New Media*, Norwood, NJ: Ablex Publishing Corporation, 1989.

Lederberg, Joshua, "Digital Communications and the Conduct of Science: The New Literacy," *Proceedings of the IEEE*, 66(11):1314–1319, 1978.

Lederberg, Joshua and Keith Uncapher, "Towards a National Collaboratory." Report of an Invitational Workshop at The Rockefeller University, March 17–18, 1988.

Lenk, Klaus, "Information Systems to Improve Citizen Interaction with Public Adminstration," *International Federation of Information Processing Societies Working Group 8.5*, Budapest, Hungary, September 8–11, 1987.

Lerman, Steven, "Project Athena at MIT," *EDUCOM Bulletin*, Winter:5–7, 1984.

Liddell, Henry George, and Robert Scott, *A Greek-English Lexicon*, 9th edition, Oxford: Clarendon Press, 1925.

Lloyd-Jones, Hugh, *Blood For the Ghosts: Classical Influences in the Nineteenth and Twentieth Centuries*, 1982.

Long, Richard, *New Office Information Technology: Human and Managerial Implications*, London: Croom Helm, 1987.

Lyman, Peter, "Reading, Writing and Word Processing: Toward a Phenomenology of the Computer Age," *Qualitative Sociology*, 7(1/2):75–89, 1984.

Lyman, Peter, "The Future of Sociological Literature in an Age of Computerized Texts," in *New Technology in Sociology: Practical Applications in Research and Work*, Grant Blank, James L. McCartney, and Edward Brent, eds., New Brunswick: Transaction Publishers, 1989.

MacDonald, Marianne, *Terms for Happiness in Euripides*, Ph.D. dissertation, University of California, Irvine, 1975.

March, James G. and Judith P. Olsen, "Choice Situations in Loosely Coupled Worlds," unpublished manuscript, Stanford University, 1975.

Markus, Lynne, *Systems in Organizations: Bugs and Features*, Marshfield, MA: Pitman, 1984.

Markus, M.L. and D. Robey, "Information Technology and Organizational Change: Causal Structure in Theory and Research," *Management Science*, 34(5):583–598, May 1988.

Martlew, Roger, "Videodiscs and the Politics of Knowledge," in David S. Miall (ed.), *Humanities and the Computer: New Directions*, Oxford: Clarendon Press, pp. 39–48, 1990.

McCarty, Willard, "A Guide To Humanist," available electronically from the editors of the Humanist mailing list, Elaine Brennan and Allen Renear, at *editors@brownvm.brown.edu*; last updated March 25, 1989.

McCredie, John W., "BITNET's Changing Role in Higher Education," *EDUCOM Bulletin*, Summer:2–5, 1984.

McDonald, Marianne, *A Semilemmatized Concordance to Euripides' Alcestis*, TLG publications series, no. 1, Costa Mesa, CA: TLG Publications, 1977.

McKirahan, Richard D., *Plato and Socrates: A Comprehensive Bibliography, 1958–1973*, New York: Garland Publishers, 1978.

McLuhan, Marshall, *The Gutenberg Galaxy*, University of Toronto Press, 1962.

McLuhan, Marshall, *Understanding Media: The Extensions of Man*, New York: McGraw-Hill, 1964.

Mead, George Herbert, *Mind, Self & Society From the Standpoint of a Social Behaviorist*, Chicago, IL: The University of Chicago Press, 1934.

Mead, George Herbert, *The Philosophy of the Act*, Chicago, IL: The University of Chicago Press, 1938.

Mellon, Constance A. (ed.), *Bibliographic Instruction: The Second Generation*, Littleton, CO: Libraries Unlimited, 1987.

Merton, Robert K., *Social Theory and Social Structure*, Glencoe, IL: The Free Press, 1957.

Mesthene, Emmanuel G., "Some General Implications of the Research of the Harvard University Program on Technology and Society," *Technology and Culture*, October, 1969.

Miall, David S., *Humanities and the Computer*, Oxford: Clarendon Press, 1990.

Mohr, Lawrence B., "Determinants of Innovation in Organizations," *The American Political Science Review*, 63, 1969.

Montaigne, Michel de, *Essays*, translated with an introduction by J. M. Cohen, Baltimore: Penguin Books, 1958.

Morton, Andrew Queen, *Literary Detection: How to Prove Authorship and Fraud in Literature And Documents*, Bowker, 1978.

Mowshowitz, Abbe, *Inside Information: Computers in Fiction*, Reading, MA: Addison-Wesley, 1977.

Mulkay, M. J., "The Social Location of Innovation," in *The Social Process of Innovation: A Study in the Sociology of Science*, chapter 5:48–54, Macmillan, 1972.

Mumford, Lewis, "Authoritarian and Democratic Technics," *Technology and Culture*, 5, 1964.

Nelson, Theodor Holm, *Literary Machines: The Report on, and of, Project Xanadu ...*, edition 87.1, Swarthmore, PA: Theodor H. Nelson, 1987.

Newsletter of the Thesaurus Linguae Graecae, Theodore F. Brunner, editor, University of California, Irvine, Irvine CA 92717, since 1973.

Nisbet, Robert, *The Social Philosophers: Community and Conflict in Western Thought*, New York: Thomas Y. Crowell Company, 1973.

Ong, Walter J., *Orality and Literacy*, London:Methuen, 1982.

Orwell, George, *1984: A Novel*, New York: New American Library, 1950, c1949.

Packard, David W., *A Concordance to Livy*, Cambridge, MA: Harvard University Press, 1968.

Pattison, Mark, *Essays by the Late Mark Pattison, Sometime Rector of Lincoln College*, collected and arranged by Henry Nettleship, Oxford: Clarendon Press, 1889.

Perrolle, Judith A., "Intellectual Assembly Lines: The Rationalization of Managerial, Professional, and Technical Work," *Computers and the Social Sciences*, 2, 1986.

Pfeiffer, Rudolf, *History of Classical Scholarship from 1300 to 1850*, Oxford: Clarendon Press, 1976.

Pfeiffer, Rudolf, *History of Classical Scholarship from the Beginnings to the End of the Hellenistic Age*, Oxford: Clarendon Press, 1968.

Pinnsonneault, Alain, and Kenneth L. Kraemer, "The Impact of Technological Support on Groups: An Assessment of the Empirical Research," *Decision Support Systems*, 5:197–216, 1989.

Polanyi, Michael, *The Tacit Dimension*, Garden City, N.Y.: Doubleday, 1966.

Potter, Rosanne G., "Literary Criticism and Literary Computing: The Difficulties of a Synthesis," *Computers and the Humanities*, 22:91–97, 1988.

Prendergast, Guy Lushington, *A Complete Concordance to the Iliad of Homer*, revised and enlarged by Benedetto Marzullo, Hildesheim: Georg Olms Buchhandlung, 1962.

Price, Derek J. De Solla, "Networks of Scientific Papers," *Science*, 149:510–515, 1965.

Raben, Joseph, "Computer Applications in the Humanities," *Science*, 228(4698):434–438, 1985.

Raben, Joseph, and C. G. Enke, "Computers in Scientific Instrumentation," *Science*, 215:785–791, 1982.

Ragin, Charles C. and Howard S. Becker, "How the Microcomputer is Changing Our Analytic Habits," in *New Technology in Sociology: Practical Applications in Research and Work*, Grant Blank, James L. McCartney, and Edward Brent, eds., New Brunswick: Transaction Publishers, 1989.

Rahtz, Sebastian (ed.) *Information Technology in the Humanities: Tools, Techniques, and Applications*, Chichester, England: Ellis Horwood Limited, 1987.

Reach: Research & Educational Applications of Computers in the Humanities, the Newsletter of the Humanities Computing Facility of the University of California at Santa Barbara, Eric Dahlin (ed.), Santa Barbara, CA 93106, 805-893-2208, *hcf1dahl@ucsbuxa.bitnet* or *hcf1dahl@ucsbuxa.ucsb.edu*, 1990–.

Reedy, Jeremiah, "Cultural Literacy and the Classics," *The Classical Journal*, 84(1):41–46, 1988.

Renehan, Robert, *Greek Textual Criticism: A Reader*, Cambridge, MA: Harvard University Press, 1969.

Rengstorf, Karl Heinrich, *A Complete Concordance to Flavius Jospehus*, volume IV: R – Ω, in co-operation with Bernhard Justus, Georgios Kontoulis, James R. Royse, Heinz Schreckenberg, Jürgen Schwark, Leiden: E.J. Brill, 1983.

Reynolds, L. D. and N. G. Wilson, *Scribes and scholars: A guide to the transmission of Greek and Latin literature*, Oxford: Clarendon Press, 1974.

Rice, Ronald, "Mediated Group Communication," in *the New Media*, Ronald Rice, ed., Beverly Hills, CA: Sage, 1984.

Rice, Ronald, and J. Bair, "Conceptual Role of New Communications Technology in Organizational Productivity," *Proceedings of the American Society for Information Science 46th Annual Meeting*, Washington, D.C., October 2–6, 1983.

Rich, Anthony, *A Dictionary of Roman and Greek Antiquities: With Nearly 2000 Engravings on Wood from Ancient Originals Illustrative of the Industrial Arts and Social Life of the Greeks and Romans*, fifth edition, London: Longmans, Green, 1890.

Rock, P., *The Making of Symbolic Interactionism*, London: Macmillan, 1979.

Rogers, Everett M., *diffusion of Innovations*, third edition, New York: Free Press, 1983.

Rogers, Everett M. and F. Floyd Shoemaker, *Communication of Innovations; A Cross-Cultural Approach*, 2nd Edition, New York: Free Press, 1971.

Rosenberg, Laurence, HICSS (Hawaiian International Conference on Software Systems) Mini-track on Collaborative Systems, Call for Papers, 1990.

Rowe, "Graduate and Professional Women," *Proceedings of the American Association for University Women Conference*, May 9–10, 1974.

Ruffolo, Lara, *Authority and Cacophony in Ricardian Poetry*, Ph.D. dissertation, University of California, Irvine, forthcoming.

Ruhleder, Karen, "Environment and Action Explanations for Understanding Technological Innovation," unpublished draft, 1988.

Ruhleder, Karen and John Leslie King, "The Academic Collaboratory as a Bridge Across Space, Time and Social Worlds," *Hawaiian International Conference on Software Systems*, January 7–11, 1991.

Rule, James, Douglas McAdam, Linda Stearns and David Uglow, *The Politics of Privacy*, New York: New American Library, 1980.

Russell, Donald Andrew, *Criticism in Antiquity*, University of California Press, 1981.

Sandys, John Edwin, *A History of Classical Scholarship, Volume III, The Eighteenth Century in Germany, and the Nineteenth Century in Europe and the United States of America*, New York: Hafner Publishing Co., 1958.

Saunders, Trevor J., *Bibliography on Plato's Laws, 1920–1976, with additional citations through March 1979*, second edition, New York: Arno Press, 1979.

Schmitt, Marilyn, "Scholars Must Take the Lead in Computerization in the Humanities," *The Chronicle of Higher Education*, p. 44, November 21, 1990.

Shaiken, Harley, *Work Transformed: Automation and Labor in the Computer Age*, New York: Holt, Rinehart, and Winston, 1985.

Shattuck, John, and Muriel Morisey Spence, *Government Information Controls: Implications for Scholarship, Science and Technology*, Association of American Universities, 1988.

Shibutani, Tamotsu, "Reference groups as perspectives," *The American Journal of Sociology*, 60:562–569, 1955.

Simpson, D. P., *Cassell's New Latin Dictionary*, New York: Funk & Wagnalls, c. 1959, reprinted 1960.

Simpson, J. A., and E. S. C. Weiner, *The Oxford English Dictionary*, second edition, Oxford: Clarendon Press, 1989.

Snow, Charles Percy, *The Two Cultures and the Scientific Revolution*, New York: Cambridge University Press, 1962.

Sproull, Lee and Sara Kiesler, "Reducing Social Context Cues: Electronic Mail in Organizational Communication," *Management Science*, 32(11):1492–1512, 1986.

Standish, Thomas A., *Data Structure Techniques*, Addison Wesley, 1980.

Star, Susan Leigh, "Layered Space, Formal Representations and Long-Distance Control: The Politics of Information'," *Conference on The Place of Science*, Van Leer Institute, Jerusalem and Tel Aviv, Israel, May 1989.

Star, Susan Leigh, "The Structure of Ill-Structured Solutions: Boundary Objects and Heterogeneous Distributed Problem Solving," in Michael N. Huhns and Les Gasser, editors, *Distributed Artificial Inteligence 2*, Menlo Park, CA: Morgan Kaufman, 1987.

Star, Susan Leigh, and Geof Bowker, "Boundary Objects, Standards, and Long-Term, Large-Scale Coordination: The Case of the International Classification of Diseases," *24th Annual Hawaii International Conference on Systems Science*, 1990.

Star, Susan Leigh, and J. G. Griesemer, "Institutional Ecology, 'Translations,' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrae Zoology, 1907–1989," *Social Studies of Science*, August, 1989.

Stasser, Susan, "The Work Women Do in a Small Rural Town," presented at the *Annual Meeting of the Midwest Sociological Society*, Des Moins, 1982.

Steinfield, Charles, "Computer-Mediated Communication Systems," in *Annual Review of Information Science and Technology*, Martha Williams, ed., 21:167–202, 1986.

Strauss, Anselm, *Negotiations: Varieties, Contexts, Processes, and Social Order*, San Francisco: Jossey-Bass, 1978 (a).

Strauss, Anselm, *Qualitative Analysis for Social Scientists*, Cambridge University Press, 1987.

Strauss, Anselm, "A Social World Perspective," *Studies in Symbolic Interaction*, pp. 119–128, 1978 (b).

Strauss, Anselm L., "Social Worlds and Legitimation Processes," *Studies in Symbolic Interaction*, 4:171–190, 1982.

Strauss, Anselm L., "Socials Worlds and Their Segmentation Processes," *Studies in Symbolic Interaction*, 5:123–139, 1984.

Strauss, Anselm L., Shizuko Fagerhaugh, Barbara Suczek, and Carolyn Wiener, "Patients' Work in the Technologized Hospital," *Nursing Outlook*, 29(7):404–412, 1981.

Sullivan, C. W., "Human Attitudes Toward Computers: Paradigms from Fiction," in Sarah K. Burton and Douglas D. Short (eds.), *Proceedings of the Sixth International Conference on Computers and the Humanities*, Rockville, MD: Computer Science Press, 1983.

Teichman, Milton, and Marilyn Poris, "Initial Effects of Word Processing on Writing Quality and Writing Anxiety of Freshman Writers," *Computers and the Humanities*, 23(2):93–104, 1989.

Thorpe, James, "Literary Scholarship: A Handbook for Advanced Students of English and American Literature," Boston: Houghton Mifflin Company, 1964.

TLG Newsletter, see *Newsletter of the Thesaurus Linguae Graecae.*

Toffler, Alvin, *The Third Wave*, Toronto: Bantam Books, 1980.

Tombaugh, Jo W., "Evaluation of an International Scientific Computer-Based Conference," *Journal of Social Issues*, 40(3):129–144, 1984.

Turkle, Sherry, *The Second Self: Computers and the Human Spirit*, New York: Simon and Schuster, 1984.

Turner, E. G., *Greek Manuscripts of the Ancient World*, Oxford, 1971.

Turoff, Murray and Starr Roxanne Hiltz, "Computer Support Systems for Group vs. Individual Decisions," *IEEE Transactions on Communications*, 30:82–91, 1982.

Updegrove, Daniel A., "Computer-Intensive Campuses: Strategies, Plans, Implications," *EDUCOM Bulletin*, Spring:11–14, 1986.

Virgil (Publius Vergilius Maro), *The Aeneid of Virgil, with English Notes, Critical and Explanatory, A Metrical Clavis, and An Historical, Geographical, and Mythological Index*, Charles Anthon, ed., New York: Harper and Brothers, 1850.

Vitalari, Nick, "Exploring the Type-D Organization: Distributed Work Arrangements, Information Technology and Organizational Design," in Milt Jenkins and others (editors), *Research in Information Systems: An Agenda for the 1990's*, Dubuque, Iowa: William C. Brown, 1990.

Walsh, Vicky A., "Computer Simulation Methodology for Archaeology," in Richard W. Bailey (ed.), *Computing in the Humanities*, Amsterdam: North-Holland, 1981.

Wagner, Elaine, "Bibliographic Instruction in the Automated Library," *Humanities and Technology Association Review*, 9(Fall):26–30, 1990.

Waite, Stephen V. F., "Computers and Classical Literature: 1970–1971," *Computers in the Humanities*, 6(1):31–34, September 1971.

Waite, Stephen V. F., "Computers and Classical Literature: 1971–1972," *Computers in the Humanities*, 7(2):99–104, November 1972.

Warren, John, "Machine Translation of Human Language," *INTERFACE '90: Fourteenth Annual Humanities and Technology Conference*, Marietta, Georgia, October 18–19, 1990.

Weick, Karl E., "Educational Organizations as Loosely Coupled Systems," *Administrative Science Quarterly*, 21:1–19, 1976.

Wess, Robert, "Robert Cormier's Ironic Use of Motor Vehicles," *INTERFACE '90: Fourteenth Annual Humanities and Technology Conference*, Marietta, Georgia, October 18–19, 1990.

West, Martin L., *Textual Criticism and Editorial Technique*, Stuttgart: B. G. Teubner, 1973.

Westra, Laura, "Perinatal Medicine: Some Ethical Considerations," *INTERFACE '90: Fourteenth Annual Humanities and Technology Conference*, Marietta, Georgia, October 18–19, 1990.

Wheeler, Helen Rippier, *The Bibliographic Instruction-Course Handbook: A Skills and Concepts Approach to the Undergraduate, Research Methodology, Credit Course: For College and University personnel*, Metuchen, NJ: Scarecrow Press, 1988.

Whisler, T., *The Impact of Computers on Organizations*, New York: Praeger Publishers, 1970.

Widman, R. L., "Computers and Literary Scholarship," *Computers in the Humanities*, 6(1):3–14, September 1971.

Widman, R. L., "Recent Scholarship in Literary and Linguistic Studies," *Computers in the Humanities*, 7(1):3–27, September 1972.

Wieckert, Kären, "The Case of the Fickle Expert System," *Proceedings of the Conference on Computers and the Quality of Life*, George Washington University, Washington, D.C., Semptember 13–16, 1990.

Wieckert, Kären, *A Social and Intellectual History of Expert Systems*, Ph.D. dissertation, University of California, Irvine, forthcoming.

Wilamowitz-Moellendorff, Ulrich von, *Die Textgeschichte der Griechischen Bukoliker*, Berlin: Weidmannsche Buchhandlung, 1906:

Wilamowitz-Moellendorff, Ulrich von, *History of Classical Scholarship.* London: Duckworth, 1982.

Winner, Langdon, *Autonomous Technology: Technics-out-of-control as a Theme in Political Though*, Cambridge, MA: MIT Press, 1977.

Winner, Langdon, "Do Artifacts Have Politics?" *Daedelus*, Winter, 1980.

Wolf, Friedrich August, *Darstellung der Alterthumswissenschaft nach Begriff, Umfang, Zweck und Werth*, Berlin: Akademie-Verlag, 1985.

Yin, Robert K., "Life Histories of Innovations: How New Practices Become Routinized," *Public Administration Review*, January/February:21–28, 1981.

Youtie, Herbert C., *The Textual Criticism of Documentary Papyri*, second edition, London:Institute of Classical Studies, 1974.

Yule, G. Udny, *The Statistical Study of Literary Vocabulary*, Archon Books, 1968.

Zelikson-Bobrovskaia, TSetsiliia Samoilovna, *Provocateurs I have Known*, New York: Workers Library Publishers, 1932.

Zolberg, Vera, *The Art Institute of Chicago: The Sociology of a Cultural Organization*, Ph.D. dissertation, University of Chicago, 1974.

Zolberg, Vera L., "Displayed Art and Performed Music: Selective Innovation and the Structure of Artistic Media," *The Sociological Quartery*, 21(Spring):219–231, 1980.

Zuboff, Shoshana, *In the Age of the Smart Machine: The Future of Work and Power*, New York: Basic Books, 1988.